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A nursing intensity system for neonatal nursing

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A NURSING INTENSITY SYSTEM

FOR NEONATAL NURSING

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ABSTRACT

This study is concerned with the development of The Neonatal Nursing Intensity System, a patient classification system for use in staff scheduling in neonatal units.

The Neonatal Nursing Intensity System was developed using quantitative method. The first part of the study consisted of the development of data collection tools to be used in activity sampling method and work sampling method data collection of nurses' activities within the neonatal unit. A pilot study was conducted to test the content validity of the tools and to validate the data collection technique of the researcher.

The main study was conducted in two neonatal units in New South Wales and examined the activities of fifty nine nurses. Six hundred and thirty two individual attendances of forty three direct care nursing interventions were observed and recorded. Indirect nursing activities were observed and recorded over twelve eight hour shifts. Simple descriptive statistics were applied to the data collected through observation to determine average attendance times for each nursing activity.

The expert judgement of sixteen Clinical Nurse Specialists was obtained in relation to the time required to attend thirty three direct care nursing

interventions. The Kendall Coefficient of Concordance was applied to the results obtained from this part of the research to ensure the reliability of the data for use in validity estimates. This data was then used to determine validity of the results of activity sampling and work sampling methods of data collection. Statistical analysis for validation was attended using the Pearson Product Moment Correlation Coefficient test.

The study has resulted in the development of the Neonatal Nursing Intensity System, a simple factorial patient classification system which could be adapted to and validated for use with staff scheduling within any neonatal unit.

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CHAPTER ONE

INTRODUCTION

CHAPTER 1: INTRODUCTION.

1.1 Introduction

Nurse staffing is a major concern for most nursing departments. It can also be a dilemma, for the patient care environment is in a constant state of change as patients are admitted, discharged, and pass through various stages of acuity. As these changes occur, staffing needs vary, often markedly. Norby Freund and Wagner (1977) put forward the view that nursing workload is generated by patients and the services they require, physicians, hospital policies, routines and many other factors. These authors commented that nursing has long been aware that the workload is changing dramatically, while at the same time being unable to provide hard evidence to support such a contention. Cuthbert (1983) stated that patient classification systems are a means by which patients are organised into discreet groups according to their need for nursing care. The most basic premise underlying a patient classification system is that it should enable the nurse to qualify and quantify individual patients needs so that adequate and safe levels of nursing care can be provided. From the nurse administrator's point of view it is the key to determining and allocating nursing resources.

Very little work has been done in the area of patient classification in neonatal care. Neonatal care has been a burgeoning specialty, expensive in the use of all resources, especially human resources. Knowledge of nurse staffing needs is inadequate, the tools used to measure patient intensity being modified from adult

systems and vague in the extreme. A reliable tool which can be used for determining the numbers of nurses necessary to provide care within neonatal units is required.

1.2 Background

Patient classification systems have not been widely used in neonatal units in New South Wales. Of those in use, some have been modified from systems used in adult nursing units (Reynolds, Barry and Rowley 1984) or have been based on the recommendations contained in the "Guidelines for Level Three Neonatal Intensive Care Units", by the Australian Health Ministers' Advisory Council (1983,1990).

1.2.1 "Guidelines for Level Three Neonatal Intensive Care Units"

In 1982 a Superspecialty Services Subcommittee was set up for the Australian Health Ministers Advisory Council to formulate guidelines for the role and function of Neonatal Intensive Care Units. This initiative resulted in the publication in 1983, and subsequent revisal in 1990, of the "Guidelines for Level Three Neonatal Intensive Care Units". The Report contained guidelines for neonatal care which included role delineation, levels of care to be provided within the designated categories, unit size, education and outreach functions, support facilities and medical and nursing staff establishments.

1.2.1.1 Levels of Care

The "Guidelines for Level Three Neonatal Intensive Care Units" recommended three categories of neonatal care. These were Level 3 or intensive care, Level 2 or special care and Level 1 or normal nursery care. Broad guidelines were provided regarding which babies should be admitted to delineated levels of neonatal unit. The recommendations for Level 3 (Neonatal Intensive Care) and Level 2 (Neonatal Special Care) are shown below:

1.2.1.1.1 Level 3

Criteria for admission to Level 3 neonatal units are outlined under "Diagnostic categories for Level Three care" (1990:10) . These categories include those neonates:

* needing sustained ventilation,
* needing cardio-respiratory monitoring for recurring apnoea or seizures,
* with extreme illness, for example, sepsis,
* needing parenteral nutrition,
* needing long-term oxygen administration.

1.2.1.1.2 Level 2

Also outlined in the Guidelines (1990:11) are criteria regarding babies who should be admitted to Level 2 neonatal units. It was noted that babies admitted to Level 2 would usually be greater than 32 weeks gestation and 1500 grams birth weight. The criteria included those neonates:

* with transient problems requiring observation,
* requiring oxygen concentrations up to 40 percent,
* needing cardio-respiratory monitoring,
* needing parenteral fluid therapy,
* needing short term assisted ventilation for stabilisation until a retrieval team could be arranged,
* convalescing following acute problems.

1.2.1.2 Nurse Staffing

Recommendations for nurse staffing set down in the Guidelines were based on diagnostic categories for admission to Level 3 or Level 2 units and\or management\diagnostic interventions during hospitalisation. The Report recommended (1990:24) that "there should be a nurse to patient ratio of 1:1 for ventilator beds and 1:2 for other Level Three beds". It was further suggested that the nurse patient ratio for Level Two be "1:3 for intermediate care and 1:5 for continuing care" (1990:24).

While most neonatal intensive care units in New South Wales place some credence on the recommendations of the Superspecialty Services Subcommittee of the Australian Health Ministers' Advisory Council (1983;1990), nurse staffing does not usually reflect these recommendations. These are recommendations only, and consist of the opinions of Neonatal Unit medical directors (pp 23,24), who consider staffing from the perspective of medical diagnosis and\or medical interventions. Unfortunately the Report does not consider time associated with

nursing care interventions, and no advice from nurses is documented. The authors of the Guidelines acknowledge the deficiency of this document in relation to recommendations for nurse staffing, stating that (1990:24) further research in the area of nurse staffing may "lead to a better understanding of the actual staff required according to the level of care needed, and ..... future standards may be better based on workload studies".

1.3 Statement of the Problem

Patient classification systems currently in use in Neonatal Units in New South Wales to determine nursing resource needs are either modified adult systems (Reynolds, Barry and Rowley 1984) or, are loosely based on the recommendations of the Superspecialty Services Subcommittee of the Australian Health Ministers' Advisory Council (1983;1990). The deficiencies related to information about nurse staffing is acknowledged by this Subcommittee in the most recent publication. To date there has been no validated patient classification system available for neonatal units in New South Wales to determine the numbers of nurses required to provide care. This presents a major problem for nurse managers, both from a day to day management perspective and for future planning of service development.

1.4 Aims and Objectives of the Study

The following section contains the aims and objectives of this study.

1.4.1 Aim of the Study

To develop a patient classification system which may be used in staff scheduling within neonatal units.

1.4.2 Objectives of the Study

To observe nursing activities and to collect data on a variety of direct nursing care interventions within the neonatal unit.

To analyse this data by statistical means to determine average time standards for individual nursing interventions.

To observe nursing activities and to collect data on a variety of indirect nursing care interventions within the neonatal unit.

To analyse this data by statistical means to determine average time standards for individual nursing interventions.

To validate the data collected through observation methods by expert neonatal nurses judgement.

1.5 Theoretical Framework for the Study

1.5.1 Introduction

The development of a system to measure the intensity of the patient's requirement for nursing care requires a theoretical framework which is acceptable to nurses and applicable to clinical practice.

Nursing theories including those of Orem, Rogers, Callista Roy, Leininger, Watson and Peplau have emerged over time, (Fitzpatrick and Whall 1983; Chinn and Jacobs 1987), and these theories have put forward varying opinions about nursing, and how nursing care is planned and delivered. A common theme in nursing theories is the notion of caring as an integral part of, and a vehicle for, nursing. Caring as a concept however, remains elusive. The literature affords no consensus regarding the definition of caring, the components of care or the process of caring as applied to nursing. Morse, Solberg, Neander, Bottorff, and Johnson (1990) offered a broad view when they suggested that it is caring which holds nursing together. Watson (1985) and Gadow (1989) both suggest that caring means being committed to maintaining the individual's dignity or integrity. To Peplau (1989), caring put nursing in the realms of an enabling, empowering, transforming art. Orem (1971;1980;1985;1991) believed that caring consisted of actions by others which become necessary when self-care requirements could not be met. Orem (1991:57) stated

> *Nursing has **form** as well as situational features with which nurses deal as nurses. The form of nursing is expressed in part by its helping and taking care of characteristics, which lay out its interpersonal form. Other aspects of nursing's form arise from the fact that nurses deal with life **situations** where results are sought,*

> *where new, not presently existent conditions are to be brought into existence through the goal orientated deliberate actions of nurses and their patients.*

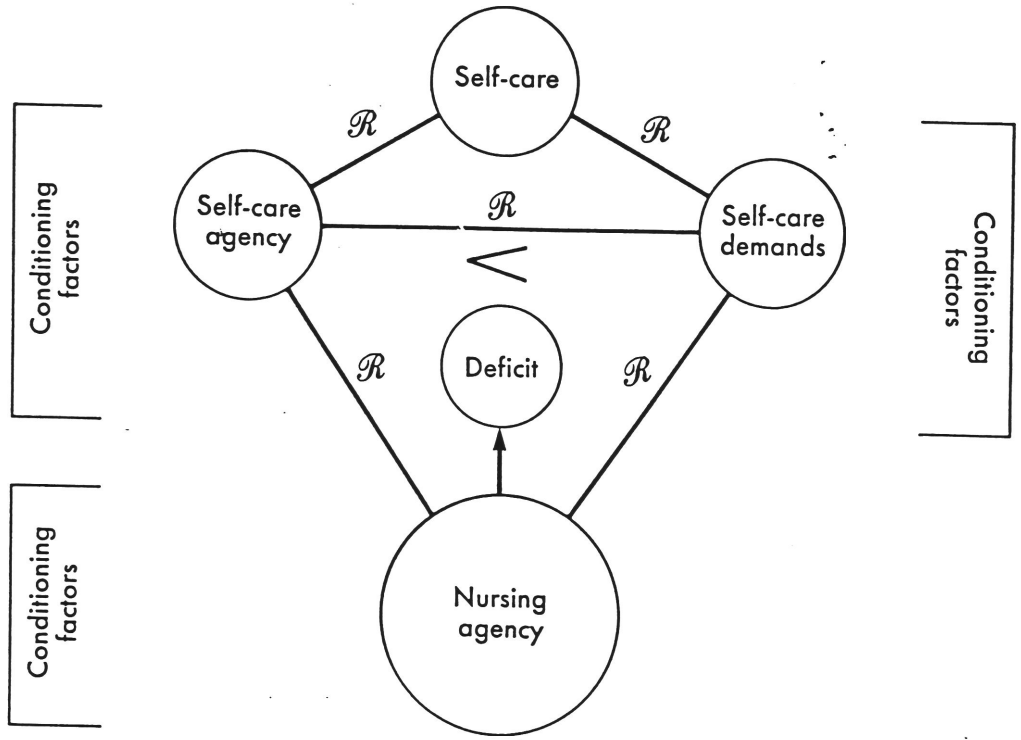
According to Orem, nursing is a human service, focussing on the individual's need for the provision and management of those self-care actions which are required to sustain life and health, or to recover from disease or injury. Orem considered that nursing included assisting the individual toward independence from nursing or a peaceful death.

Orem's notion that caring is demonstrated as activities which assist an individual unable to meet his\her own needs, and her expression of nursing's form and role in life situations, is readily adaptable to neonatal nursing. This has been clearly illustrated by Tolentino (1990) in her work in the neonatal area. For this reason the theoretical framework used for the development of this research is Orem's self-care deficit theory.

1.5.2 Orem's Self Care Deficit Theory

Orem's conceptual framework for nursing as illustrated in Figure 1.1 was outlined in 1970, twenty years after she began work on the theory she termed the Self Care Deficit Theory. Some refinement and development has taken place since then, but essentially the model has remained the same.

Figure 1.1: Orem's Conceptual Framework For Nursing.



R = relationship; < = deficit relationship, current or projected. (Orem 1991:66).

Orem's theory is composed of three interrelated theories, the theory of self-care, the theory of self-care deficit and the theory of nursing systems. These are outlined in the following sub-sections.

1.5.2.1 Theory of Self-Care

Central to the theory of self-care (Orem 1991:69-70) is the notion that self-care is purposeful and contributes to human integrity, function and development. Orem described self-care and care of dependent family members as the actions, or learned behaviours, directed by the individual to the self, or to the

environment, in order to regulate development and functioning. The actions required are termed therapeutic self-care demand and are carried out by an agent. A self-care agent is the provider of self-care, and a dependent care agent is the provider of infant care, child care or dependent adult care. The consideration of the dependent care agent is essential in neonatal nursing where parent education to prepare for care after discharge is a large component.

1.5.2.2 Theory of Self-Care Deficit

Orem's theory of self-care deficit maintains that individuals experience self-care deficit when they are unable to care for themselves (Orem 1991:70-71). Individuals require and benefit from nursing because they are subject to health-related or health-derived limitations which render them incapable of self-care or dependent care, or where that care is ineffective or incomplete. The condition which validates the existence of a requirement for nursing in an adult is the inability to maintain that amount and quality of self-care which is therapeutic. In the child, nursing is validated by the inability of the parent or guardian to maintain for the child that amount or quality of self-care which is therapeutic. Neonatal units exist solely to provide care for babies who, because of illness, are unable to be cared for by their parents.

1.5.2.3 Theory of Nursing Systems

In Orem's theory, nursing systems are formed when nurses prescribe, design and provide nursing care for patients (individually or collectively) to complement the patient's ability for self-care or dependent care (Orem 1991:72-73).

1.5.2.4 Self-Care Requisites

Central to Orem's theory are what she termed self-care requisites. The term "requisite" is used to mean an activity which an individual must perform in order to be self caring. Orem described these as universal self-care requisites, developmental self-care requisites, and health deviation self-care requisites.

Universal self-care requisites are common to all human beings regardless of age, health status, level of development and environmental surroundings. These activities include the maintenance of air, water and food; elimination; activity and rest; solitude and social interaction; prevention of hazards to life, functioning and well-being; and promotion of normalcy (Orem 1991:127). When effectively provided, self-care or dependent care organised around universal self-care requisites fosters positive health and well-being.

In addition to universal self-care requisites essential for all individuals, Orem identified a second kind of requisite associated specifically with human development. These developmental self-care requisites promote processes for life and maturation and prevent conditions deleterious to maturation (Orem 1991:130). Orem considers there are two classifications of developmental self-care requisites (1991:130-131). The first relates to bringing about and maintaining conditions which support life processes and promote development. This is associated with specific developmental stages and include intrauterine life and birth, neonatal life, infancy, childhood and adolescence. At such stages special consideration must be given to aspects of care necessary to the support of

life and specifically targeted at promoting development. Orem argues that at each of these developmental stages universal self-care requisites must be considered, but there may also be specific health-care demands because of the prevailing developmental level of the individual. An example would be the neonate and temperature regulation: where healthy adults are able to manage the control of their own body temperature, for developmental reasons a neonate requires assistance in meeting this need. The second developmental self-care requisites involves the provision of care associated with conditions which can adversely affect human development. An example would be the provision of adequate nutrition during pregnancy, and the effect of this on mother and baby.

The final self-care requisites in Orem's model, are the health deviation self-care requisites. These requisites exist when individuals are ill, become injured, have disabilities or are under medical care and are unable to manage their own self care. These changes in health status require an individual to seek assistance and advice from others competent to offer this (Orem 1991:132), and an example would be pregnancy and the care of the sick neonate.

1.5.2.5 Summary

According to Orem, individuals able to manage their own self-care can:

* support essential physical, psychological and social life processes;
* maintain human structure and function;
* develop their human potential to the fullest;
* prevent injury or disease;

* cure or regulate disease (with appropriate assistance);
* cure or regulate the effects of disease (with appropriate assistance).

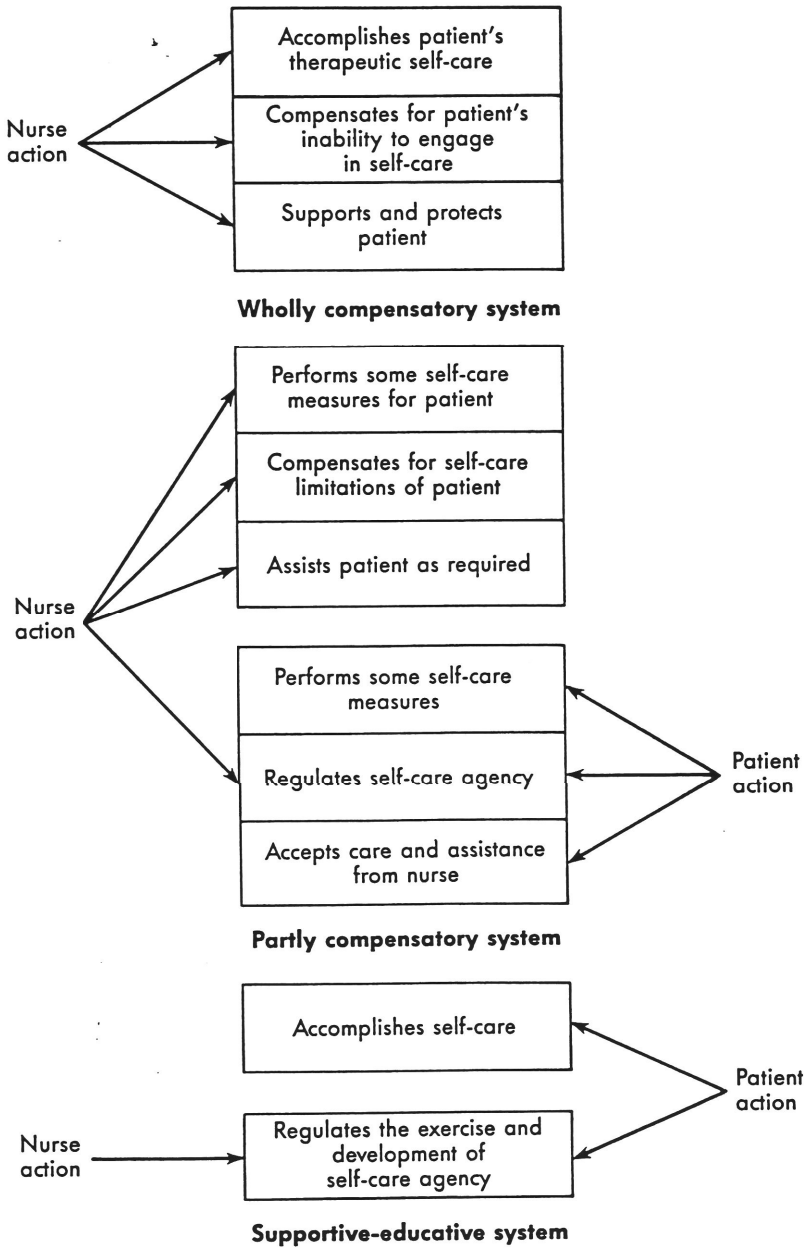
When the therapeutic self-care demand is greater than self-care agency, self-care deficit is said to exist.

1.5.2.6 Application of Orem's Theory

Orem has stressed throughout her model that nursing is action, and ideas must be translated into a form which can be utilised in practice (1991:269). To apply Orem's theory to clinical nursing it is necessary to determine why the patient requires nursing. This involves assessment of the therapeutic self-care demand and the potential to provide self-care, followed by the establishment of the self-care deficit. When this assessment is complete, the presence and extent of a self-care deficit can be determined and the theory of nursing systems enacted.

In Orem's theory, nursing systems are formed when nurses prescribe, design and provide nursing care for patients based on the assessed self-care or dependent-care deficit (Orem 1991:72-73). Orem divided her theory of nursing systems into three subsystems. Firstly, a wholly compensatory system where acting and doing for the patient is central, secondly, a partially compensatory system where either the nurse or the patient may have the major role, and thirdly a supportive-educative system wherein support, guidance, provision of a developmental environment and teaching are central components. Figure 1.2 outlines the nursing and patient actions required in each of the three systems.

Figure 1.2: Orem's Basic Nursing Systems



(Orem 1991:288).

1.5.3 Adaptation of Orem's Theory to Neonatal Care

Newborn babies, because of their appearance of helplessness and dependence on others do not appear to have the potential for self-care. In the neonate, self-care manifests as communication mechanisms which alert the dependent care agent to act on their behalf and fulfil their needs. According to Tolentino (1990) and Affonso (1976) these communication mechanisms are present from birth. With the normal newborn, the parents are able to fill the role of the dependent care agent. In the case of the sick neonate, the dependent care agent is unable to provide for the child the amount or quality of care which is therapeutic and a self-care deficit exists in the universal, developmental and health deviation self-care requisites.

The ill neonate, nursed in the neonatal intensive care unit, retains some potential for self-care. In this instance, the infant's communication systems may manifest as behavioural or physiologic signals which are interpreted by the nurse as self-care deficits requiring nursing intervention (Tolentino, 1990; Affonso, 1976). Signalling actions such as self-pacifying behaviour may indicate the infant needs to rest so the nurse would not perform any nursing interventions at this time. Restlessness may indicate discomfort requiring a position change, increased mouthing or sucking movements may indicate hunger. Negative signalling such as episodes of apnoea or bradycardia during procedures may be a communication of non-tolerance of that procedure, and decreasing oxygenation levels may be the signal that the infant has excessive secretions and requires suction. Positive signalling actions such as a decreased number of apnoeic or bradycardic episodes

and maintenance of good oxygenation levels may indicate that the infant is ready to tolerate weaning from oxygen. A plan of care designed for a neonate in the Intensive Care Unit would be a wholly compensatory system, incorporating that individual's potential for self-care. Included would be observation and documentation of responses to interventions, then withholding stimuli or modifying nursing actions that elicit avoidance behaviour and support positive reactions.

As the neonate's potential for self-care increases, and the dependent care agent's potential for meeting the therapeutic care demand increases, the focus of nursing changes. Rather than being compensatory for the infant, the focus becomes being supportive and educative for the parents as dependent care agents in the areas of universal, developmental and health deviation care requisites. A neonate in the Special Care Nursery would require a plan which was partially compensatory with an emphasis on education for the dependent care agent. Tables 1.1 and 1.2 illustrate therapeutic self-care assessment and nursing care plan for a neonate in the Intensive Care Unit. Tables 1.3 and 1.4 illustrate therapeutic self-care assessment and nursing care plan for a neonate in the Special Care Nursery.

Table 1.1: Therapeutic Self-care Demand Assessment: Infant Requiring Ventilation for Meconium Aspiration

SELF-CARE DEMANDS	ASSESSMENT
Universal Demands. 1. Maintenance of sufficient intake of air, water and food.	* Requires ventilation support due to meconium aspiration\pneumonitis * Nil orally due to respiratory disease. Receiving total parenteral nutrition via central venous line.
2. Provision of care associated with eliminative processes.	* Urine output is more than 2mls\kg\hour. * Reduced gastro-intestinal function due to nil orally. Orogastric tube in place to maintain gastric decompression.
3. Maintenance of balance between activity and rest.	* Sleeps better when positioned on side and swaddled. * Requires sedation to sleep and avoid resistance to ventilation. * Has limited activity secondary to presence of endotracheal tube, intravenous cannula, and monitoring cables.
4. Maintenance of balance between solitude and social interaction.	* Responds to mother's voice and gentle temporal massage.
5. Prevention of hazards to life, functioning and well-being.	* Communicates pain and discomfort by attempts to cry. * Reacts to painful stimuli by decreasing oxygenation.
6. Promotion of Normalcy.	* Communicates discomfort by restlessness and crying.
Health Deviation Demands. 1. Changes in human structure.	* Born with meconium aspiration.
2. Changes in physical functioning	* Has limited mobility due to presence of cannula and monitoring cables. Has endotracheal and orogastric tube in situ.
3. Changes in behaviour and habits of daily living.	* Unable to commence oral feeding regime. * Unable to distinguish night and day because of environmental lighting.
Developmental Demands. 1. Physical development	* Growth rate appropriate for gestational age. * Respiratory function compromised due to meconium aspiration.
2. Motor development	* Performs controlled movements appropriate for age, such as sucking and purposeful movements in response to painful interventions.

Table 1.2: Nursing Care Plan: Infant Requiring Ventilation for Meconium Aspiration

NURSING DIAGNOSIS	EXPECTED OUTCOME	METHODS OF HELPING AND NURSING ACTION.
Self-Care Deficit. 1. Ineffective breathing patterns related to effects of meconium aspiration.	Neonate will gradually be weaned from ventilator and breathe normally.	*Acting For or Doing For Another:* Assess appropriateness of ventilation support. Assess heart rate, respiratory status and colour 1\24 and monitor blood gases 4\24. Suction E.T.T. 1\24. Attend chest physiotherapy 2\24.
2. Alteration in nutrition: inability to feed due to respiratory disease.	Neonate will gradually be graded to full breast feeding.	*Acting For or Doing For Another:* Maintain nil orally. Maintain gastric decompression. Maintain total parenteral nutrition as per medical orders. Monitor intake and output. *Supporting Another:* Encourage mother to express breast milk.
3. Lack of social interaction related to need for ventilation.	Neonate will react appropriately to gentle stimulation, touching, holding and talking.	*Providing a Supportive Environment:* Talk to the baby while providing nursing care, soothe and pacify when upset. *Supporting Another:* Encourage parents to soothe and pacify by gentle stroking.
4. Alteration in normal sleep pattern related to environmental factors such as light or noise.	Neonate will show no signs of sleep interruption after making environmental changes	*Providing a Supportive Environment:* Dim lights to simulate the normal cycle of night and day; provide soothing touch to keep the neonate calm; plan nursing activities to provide for periods of rest and sleep; lower volume of alarms.
5. Impairment of skin integrity related to presence of tape around endotracheal tube.	Neonate will regain skin integrity.	*Acting For or Doing For Another:* Use skin preparation under tape. Avoid excessive use of tape.
Dependent Care Agent Deficit. 1. Impaired coping mechanism related to overwhelming crisis	Parents will progressively express fears, concerns and feelings of lack of control.	*Supporting Another:* Encourage expressions of feelings, stay with parents while they visit, and initiate contact with social worker.
2. Knowledge deficit in neonatal care	Parents will express interest in learning new parenting skills	*Guiding Another:* Assess parents readiness to participate in care. *Supporting Another:* Encourage parents to participate in activities. *Teaching Another:* Teach parents to progressively expand the activities they are able to attend.
3. Inadequate personal resources related to change of environment.	Parents will express desire for support from others.	*Supporting Another:* Introduce parents to other parents within the unit. Encourage mother to attend support group meetings.
3. Impaired maternal and infant bonding related to neonate's prolonged hospitalisation.	Parents will increase attachment to neonate throughout the course of the hospitalisation.	*Supporting Another:* Keep parents informed of neonate's care, treatment and condition; write down various mannerisms for the parents; reassure parents that they are able to help care for the neonate, encourage parents to bring in clothes, and toys, encourage parents to touch neonate, encourage parents to take photographs.

Table 1.3: Therapeutic Self-care Demand Assessment: Preterm Infant Requiring Headbox Oxygen and Orogastric Tube Feeding

SELF-CARE DEMANDS	ASSESSMENT
Universal Demands.	
1. Maintenance of sufficient intake of air, water and food.	* Requires oxygen administered by headbox due to prematurity and incomplete lung function. * Requires orogastric tube feeding due to prematurity and inefficient suck\swallow reflex. * Requires second hourly feeding due to small gastric capability. * Gaining weight normally for postnatal age.
2. Provision of care associated with eliminative processes.	* Urine output is more than 2mls\kg\hour. * Stools are normal in amount, frequency and appearance for gestational and postnatal age.
3. Maintenance of balance between activity and rest.	* Sleeps better when cover is placed over incubator. * Settles with pacifier and when listening to tapes of mother's voice. * Has limited activity secondary to monitoring cables and confinement to incubator.
4. Maintenance of balance between solitude and social interaction.	* Enjoys being cuddled, responds to mother's voice and gentle massage.
5. Prevention of hazards to life, functioning and well-being.	* Communicates pain and discomfort by crying. * Occasionally reacts to painful stimuli by apnoeic and bradycardic episodes.
6. Promotion of Normalcy.	* Reflexes are present. * Pacifies self by hand sucking. * Communicates discomfort by restlessness and crying.
Health Deviation Demands.	
1. Changes in human structure.	* Born at 33 weeks gestation.
2. Changes in physical functioning	* Has orogastric tube in situ. * Has limited mobility due to presence of monitoring cables and confinement to incubator.
3. Changes in behaviour and habits of daily living.	* Unable to distinguish night and day because of environmental lighting.
Developmental Demands.	* Unable to suck due to prematurity. * Growth rate appropriate for gestational age.
1. Physical development	* Respiratory function not fully developed due to prematurity. * Gastric function not fully developed due to prematurity.
2. Motor development	* Performs certain controlled movements appropriate for age, such as sucking.

Table 1.4: Nursing Care Plan: Preterm Infant Requiring Headbox Oxygen and Orogastric Tube Feeding

NURSING DIAGNOSIS	EXPECTED OUTCOME	METHODS OF HELPING AND NURSING ACTION.
Self-Care Deficit. 1. Ineffective breathing patterns related to effects of prematurity.	Neonate will gradually be weaned to room air and breathe normally.	*Acting For or Doing For Another:* Assess appropriateness of oxygen therapy. Assess heart rate, respiratory status and colour 2\24 and monitor blood gases daily.
2. Alteration in nutrition: inability to suck due to prematurity.	Neonate will gradually be graded to full breast feeding.	*Acting For or Doing For Another:* 2\24 orogastric tube feeding. Encourage non-nutritive sucking for comfort. Monitor intake and output.
3. Lack of social interaction related to confinement of incubator.	Neonate will react appropriately to gentle stimulation, touching, holding and talking.	*Providing a Supportive Environment:* Provide mobiles and toys for visual and auditory stimulation; talk to the baby while providing nursing care. *Supporting Another:* Encourage parents to cuddle neonate.
4. Alteration in normal sleep pattern related to environmental factors such as light or noise.	Neonate will show no signs of sleep interruption after making environmental changes	*Providing a Supportive Environment:* Place a cover over crib to simulate the normal cycle of night and day; provide soothing music to keep the neonate calm; plan nursing activities to provide for periods of rest and relaxation; lower volume of alarms.
Dependent Care Agent Deficit. 1. Impaired coping mechanism related to overwhelming crisis	Parents will progressively express fears, concerns and feelings of lack of control.	*Supporting Another:* Encourage expressions of feelings, stay with parents while they are visiting, and initiate contact with social worker.
2. Knowledge deficit in neonatal care	Parents will express interest in learning new parenting skills	*Guiding Another:* Assess parents readiness to care for neonate. *Supporting Another:* Encourage parents to participate in care, such as bathing and changing nappies. *Teaching Another:* Teach parents to progressively expand the activities they are able to attend.
3. Impaired maternal and infant bonding related to neonate's prolonged hospitalisation.	Parents will increase attachment to neonate throughout the course of the hospitalisation.	*Supporting Another:* Keep parents informed of neonate's care, treatment and condition; write down various mannerisms for the parents; verbally reassure and reinforce parents that they are able to help care for the neonate, encourage parents to bring in clothes, and toys, encourage parents to touch and hold neonate, give photographs of the neonate to the parents.

1.5.4 Critique of Orem's Theory

Orem's theory of nursing has been examined and critiqued by other nurses. Smith in Parse (1987) criticised Orem's theory development and commented that "there is obfuscation, circularity of meaning, weak supporting theoretical substance and logical inadequacy" (p103). Smith (1987:104) went on to say however, that Orem's theory has been readily accepted by other nurses, frequently being used in education, practice and research. Marriner-Tomey (1989) supported Smith's comments and stated that Orem's Self-Care Deficit Theory had achieved greater acceptance by nurses than the works of many other theorists.

1.6 Definition of Terms

For this study direct nursing care activities have been considered as those activities where the nurse was directly involved in care giving for the patient. Indirect nursing activities are those which relate to nursing care of the patient, individually or collectively, but do not include direct care interventions.

The definition of a Level 3 Unit or Neonatal Intensive Care Unit has been taken from The Guidelines for Level Three Intensive Care (Australian Health Ministers' Advisory Council 1991:10) which state "These facilities should be situated in a major general, maternity or childrens' hospital...the features of a Level 3 unit are the availability of continuous assisted ventilation, staff intensity related to the need for constant observation and monitoring of a neonate in a

critical state, and the availability of backup facilities in terms of consultants and sophisticated technology".

The definition of a Level 2 Unit or Neonatal Special Care Unit also has been taken from The Guidelines for Level Three Intensive Care (Australian Health Ministers' Advisory Council 1991:10) which state: these facilities "are generally located in the larger urban or suburban hospitals with obstetric services...facilities generally consist of an area for the special care of neonates who are moderately ill. Infants admitted to a Level 2 unit are in general of more than 32 weeks gestation and over 1,500 grams birthweight".

A more detailed explanation of terms used in this study including technical terms related to neonatal nursing is included in the Glossary.

1.7 Outline of the Thesis

The remainder of the thesis will adopt the following presentation. The literature will be reviewed in Chapter 2. In Chapter 3 the research design, pilot study and validation of timings are discussed followed by the method of the main study in Chapter 4. The results of the study are presented in Chapter 5 followed by the discussion in Chapter 6. The Neonatal Nursing Intensity System development is shown in Chapter 7 and conclusions and recommendations stated in Chapter 8.

CHAPTER TWO

LITERATURE REVIEW

CHAPTER 2: LITERATURE REVIEW

2.1 Introduction

There is a wealth of information published regarding patient classification systems, most of that work originating from studies undertaken in The United States of America, Canada and Britain.

In this review of related literature the following areas will be addressed; the purposes and types of patient classification systems; methodological frameworks used in patient classification system development; usage of patient classification systems; documented patient classification systems including general patient classification systems, and systems which relate to neonatal care; differing methods used to acquire data; measurement of validity and reliability estimates; strategies for implementation of patient classification systems, and necessary components of patient classification systems.

2.2 Purpose of Patient Classification Systems

The primary purpose of a patient classification system is to enable the health care institution to respond to the varying care requirements of patients by providing the appropriate nursing resources. According to Norby, Freund and Wagner (1977) it is through the provision of the appropriate quantity and mix of staff that a nursing department's philosophy, goals and services are transformed from the abstract to reality.

Cooper, Cosgrove and Warnick (1986) stated that patient classification systems arose primarily from clinical rather than economic considerations. Moores (1983) commented that dependency based schemes were aimed primarily at measuring workload to assist in better deployment of staff rather than setting staff establishments. Many authors (Vaughan and MacLeod 1980; Williams 1983; Niemeier and Reed 1985; Gallagher 1987; Pardue and Dick 1986; Huckabay 1988; Jennings, Rea, Antopol, and Carty 1989; de Groot 1989) consider the objectives of patient classification systems to be threefold. Firstly, to balance the numbers of nurses available with the need for nursing care within the institution; secondly, to provide information for future planning and service development; and thirdly, to determine budget requirements and set differential patient charges.

2.3 Types of Patient Classification Systems

Patient classification systems were defined by Abdellah and Levine (1979) as consisting of two types, namely prototype evaluation and factor evaluation. The difference between the two relates to the actual design of the classification instrument. The prototype evaluation system generally describes the characteristics of patients typical to each category. In the factor evaluation type, a number of critical indicators of direct care requirements are separately rated and then combined to designate a patient's category. Schroeder, Rhodes and Shields (1984) described the prototype system as a category orientated system, and the factor evaluation type as a workload measurement or task orientated system. The two types are also respectively referred to as subjective (prototype)

and objective (factor evaluation). This terminology could be considered misleading, because some measure of subjectivity is inevitably involved in any assessment of patients' nursing care requirement.

Dijkers and Paradise (1986) discussed the development of both types of systems. These authors stated that the prototype system provided for the development of profiles of three or more typical patients whose needs for nursing ranged from basic through to intense. Each profile outlined characteristics such as activities of daily living, need for treatments, and emotional or behavioural state, and were numbered from one through to four or five. Nurses classified their patients by determining which profile each patient most resembled. The number of the profile selected was taken to express the need for nursing care. The selected numbers of profiles of all patients on a ward were totalled to determine the required number of nurses. The factor evaluation type, as described by Dijkers and Paradise, provided for the identification of the most frequently attended or most time consuming direct care nursing activities. These activities were listed on a form, and the nurse classified the patients according to which activities the patient required. Each activity allocated a number of points with each point representing a certain number of minutes. These points were multiplied by frequency to obtain the total time per day or shift, and the required number of nurses was calculated.

Both the prototype and factor evaluation systems used average care times for each patient as a method of determining staffing requirements. These average times may have been derived from work sampling analysis: (Connor 1961;

Poland, English, Thornton and Owen 1970; Norby, Freund and Wagner 1977; Gibson, Buxton, Caine and O'Brien 1986), from activity sampling: (Vail, Morton and Reider 1987; de Vries 1987; Adams 1986), from self timing: (Cochrane and Deer 1975; Sovie, Tarcinale, Vanputtee and Stunden 1985; Freitas, Helmer and Cousins 1987;) or from the expert opinion of nurses in the field: (Cullen and Civeta, Briggs and Ferrara 1974; Barham and Schneider 1980; Curtis 1977; Chagnon, Audette, Lebrun and Tilquin 1978; Williams and Murphy 1979; Reitz 1985; O'Brien 1986).

A more recent development in patient classification systems is the use of computerised systems based on nursing diagnosis or standards of practice as part of a total system considering acuity, staffing and nursing costs (Miluleky and Ledford 1987; Mehmert, Drakel and McKeighen 1989; Vousden 1989; Silva and Aderholdt 1989).

2.4 Usage of Patient Classification Systems

In 1979 Giovanetti estimated that some 1,000 hospitals were using some form of patient classification system. The majority of these systems were based on a small number of methods, such as that proposed by Connor who had used a work sampling approach to develop a prototype system in the 1960's. de Vries (1987) reported similar findings to Giovanetti's regarding the numbers of patient classification systems being used and approaches used to determine nurse staffing, supporting Vaughan and MacLeod's comments in 1980 that nurse

staffing studies had progressed very little since the earliest research was undertaken some 20 years previously.

Scherer and Mackenzie (1980) undertook a study of major hospitals in Canada to determine the usage of patient classification systems in that country. These authors surveyed 126 hospitals and received a 73% response rate from their survey. Forty seven percent of respondents reported usage of some form of patient classification system, with these systems falling within four main types (see Table 2.1).

Table 2.1: Usage of Patient Classification Systems - Scherer and Mackenzie (1980)

Types of Classification Systems	Percentage
Based on government funded research	67.50%
Internally developed systems	20.00%
Systems developed by external management consultants	7.50%
Commercially available systems	5.00%

Nagaprasanna (1988) surveyed 251 hospitals in the United States of America regarding their use of patient classification systems and reported an 85% return rate. This author found that while 25% of respondents used a system other than a patient classification system for staff allocation, the remaining 75% used some form of patient classification system, either internally developed or commercially available. Nagaprasanna's findings showed a significantly greater use of patient

classification systems than that determined by Scherer and Mackenzie in 1980 (see Table 2.2).

Table 2.2: Usage of Patient Classification Systems - Nagaprasanna (1988)

Types of Patient Classification System	Percentage
Other methods of patient allocation	25.00%
Internally developed systems	42.00%
Systems developed by external management consultants	17.00%
Commercially available systems	16.00%

Wake (1990) also undertook a large study of the use of patient classification systems in the United States of America. Of the 918 hospitals surveyed, the results of this survey showed that 31% of respondents used internally developed patient classification systems, while the other 69% reported the use of one of the more than 100 commercially available systems. Wake illustrated the increasing usage of patient classification systems in her study by showing that the non-use of these systems amongst the surveyed hospitals in 1986 had been 13%, was currently 4% and was projected to be 1% in 1992.

2.5 Theoretical Frameworks Used in Patient Classification System Development

In 1973 Aydelotte outlined four methods used to develop systems for predicting the numbers and skill levels of nurses required to provide care within the hospital

setting. Aydelotte termed these methods descriptive, industrial engineering, management engineering and operations research.

Halloran and Vermeersch (1987:27-28) agreed with Aydelotte's descriptions and expanded on each method. These authors pointed out that the descriptive method as applied to nurse staffing was best described as being based on experience and judgement, using surveys and questionnaires during data collection. According to Halloran and Vermeersch (1987), the outstanding weakness of the descriptive method was the lack of consistency among users, but the major contribution of this method was that it was the beginning of attempts to predict future staffing needs.

Halloran and Vermeersch (1987) pointed out that the industrial engineering method was developed in the 1950's, adapting techniques designed for and used in industry to improve productivity. The authors noted that the United States Department of Health, Education and Welfare used this method, thereby influencing the spread of industrial engineering as the major research method used in nurse staffing in the 1960's and 1970's. The purpose of the industrial engineering method, according to the authors, was to optimise existing staff mix. Engineering concepts such as task analysis and work sampling were applied to nursing, with time and motion studies being the primary form of data collection. Halloran and Vermeersch (1987) pointed out that the industrial engineering method was also based on certain assumptions, namely; that industrial engineering concepts were directly applicable to nursing, that nursing was described and measured by tasks and activities, and that quality nursing care was

a function of the efficiency of task performance. The authors commented that, as early as 1962, the appropriateness of the industrial engineering method was questioned on the basis of these assumptions. The concept underlying this method, according to Halloran and Vermeersch (1987), was that nursing was defined as a set of tasks which could be performed by a variety of personnel. Nursing activities were examined to determine those which were best performed by nurses or which could be transferred to other personnel to increase productivity, this resulted in the distribution of work from scarce resources to more abundant resources. Halloran and Vermeersch (1987) commented that the industrial engineering concept of nursing was fallacious and detrimental to quality of care, however despite the inherent problems with this method, blanket task transfer and\or skill level substitution remained the major solution to the perceived problem of nurse staffing. The weaknesses of the industrial engineering method were considered by Halloran and Vermeersch (1987) to be; that the assumptions may not be valid, and that there was a lack of control of other variables such as patient need or hospital environment. The major contribution of the industrial engineering method was felt to be increased sophistication in the method used, the consideration and control of more variables and improved consistency in the application of the method and interpretation of results. Halloran and Vermeersch (1987) stated that both the descriptive and industrial engineering methods were limited by a reliance on a direct, positive relationship between staff and census, individual patient needs were not considered. Their real value stemmed from the contribution each made to subsequent developments.

Halloran and Vermeersch (1987) discussed the management engineering method, and pointed out that it developed from industrial engineering and operations research methods. The management engineering method combined industrial engineering concepts and techniques such as work measurement and work simplification with those of operations research, principally variations in nursing workload and patient classification. The variables studied included selected nurse characteristics, patient characteristics and hospital characteristics. This method was also said to be based on certain assumptions, which included the notions: that industrial engineering and operations research concepts were directly applicable to nursing, that nursing was described and measured by the selected nurse, patient and hospital characteristics, that quality nursing care would remain the same or increase by optimising nursing workload, that the concepts of average care and average patient were valid, that nursing care consisted of a series of discrete tasks which did not vary with nurse, patient, unit, time or hospital, that the necessary skill and knowledge for any task could be identified and assigned, that the units sampled represented all units, and that standard times for procedures were valid and reliable. Halloran and Vermeersch (1987) argued that this method possessed inherent weaknesses, including many assumptions which had not been tested for validity. The authors indicated that the management engineering method had been widely adopted by consulting groups, and that considerable expenditure had been made by individual hospitals for this type of staffing study since its development in the mid 1960's. The management engineering method continued to be quite popular as it allowed a conceptualisation of nursing which was meaningful to both nurses and administrators. The major contribution of this method was felt to be that the

protocol applied was clear and consistent, and produced a solution which was easily implemented.

Halloran and Vermeersch (1987) considered the methods developed through operations research to be more complex than either descriptive, industrial or management engineering methods. The operations research method followed the development of industrial engineering in the early 1960's, and was facilitated by an increasing computer technology. Data collection and analysis were the same as with industrial engineering, but included system analysis. Variables studied included patient classification, tasks and cost. Halloran and Vermeersch (1987) pointed out that there were several assumptions underlying this method. These were that operations research concepts were applicable to nursing; that nursing was described and measured by task complexes, patient classifications and cost; that quality nursing care would remain the same or increase by optimising nursing workload; that nurse staffing was a function of available personnel and optimal workload; that patients could be classified into three or more distinct categories and that the classification scheme was valid and reliable. The major weaknesses of this method were seen to be; that there were many assumptions which had not been tested for validity, that the problem was not defined effectively, and that models were site specific. The authors stated that despite the weaknesses of this method, the process produced information, including patient needs and the hospital system, based on a well defined protocol. The major contribution of this method was said to be the ability to manage complex situations, providing a more objective and consistent means to make staffing decisions.

MacDonald (1983) discussed methods used in nurse staffing and considered that there were three models for determining nursing resources. The first model discussed was the scientific model which was concerned with the measurement of workload by objective methods or techniques such as activity sampling and time studies. This model was similar to that described by Aydelotte (1973) as the industrial engineering method. The second model described by MacDonald (1983) was the social model, concerned with the subjective and behavioural influences which determined the need for nurses and the way nursing judgements and care were provided. This model is similar to Aydelotte's descriptive model. MacDonald (1983) discussed a third model, the economic model, said to measure outcome. MacDonald (1983) noted that this model considered cost effective analysis and cost benefit analysis of patient care.

Reitz (1985) put forward the view that management engineering systems were widely employed for years to establish nurse staffing systems. Reitz argued that industrial engineering and management engineering techniques measured the work of nurses and emphasised the physical care tasks, resulting in minutes of care being taken as a proxy for nursing practice. It was Reitz' view that this concept failed to take into account the continuous intellectual process which constitutes the nurses's distinctive contribution to patient care. Jennings, Rea, Antopol and Carty (1989) supported Reitz' view that industrial engineering techniques were too reductionist and mechanistic to depict the total domain of nursing. These authors argued that this method was an integral part of the development of early patient classification system, and regardless of the possible

limitations, most patient classification systems currently in use were based on various modifications of industrial engineering method.

2.6 Method of Data Collection for Patient Classification System Development

Since the first attempts to devise patient classification systems in the 1960's, various methods have been used to determine nursing time associated with patient care. Many patient classification systems have been developed from industrial engineering techniques using time and motion studies, which according to Barnes (1983) were first undertaken by Frederick Taylor in 1881 at the Midvale Steel Company.

Hagerty, Cheng, and Spengler (1985) discussed work sampling method and suggested that this management engineering technique, extracted from a scientific management framework, could be applied within the health care setting. This theory supported the analysis of tasks and task functions, purporting that specific work activities could be subdivided into smaller components. Work sampling used quantitative tools and methods, which according to these authors resulted in more effective management of human resources. Hagerty, Cheng, and Spengler argued that the theory of work sampling was based on the laws of probability, and that from a sample of employee activities, generalisations could be made regarding how employees spent their time. Hagerty, Cheng, and Spengler (1985) supported the concept of applying work sampling method to patient classification systems and suggested that work sampling studies could be designed

and conducted in a number of ways. These included observer recording and self timing by individuals involved. These methods were seen to have advantages and disadvantages. Observer timing method offered more accurate results, and reduced the possibility of falsification of the data. However, it was more time consuming, may require training for the observer, and in some instances, biased the activities of the employee.

Williams (1983) discussed the methods of work sampling by observation and self recording by nurses. Williams (1983) suggested that there was a clear advantage to self recording in that all staff members serve as data collectors and large amounts of data can be gathered. It was noted, however, that self recording required orientation and training for all personnel. It was Williams' view that where a high degree of accuracy was desired, observed recordings should be the method of choice. Williams (1983) suggested that the essential problem of measuring nurses activities remained unsolved, as few activities were discrete entities with beginning and ending points, and many direct care nursing activities were multiple in purpose. Williams (1983) believed that the problem associated with measuring nurses activities could be considered conceptual in nature as well as one of measurement. A limitation applicable to all work sampling methods is that their very use may emphasise the time factor in nursing practice, thereby promoting an industrial efficiency model of nursing care. In 1980 Hancock wrote that work sampling and activity sampling in nursing could be unreliable as nurses usually work at a speed which allowed completion of the work within a given time.

Marks (1987) put forward the view that the most efficient way to determine valid work measurement information was through the use of intensive structured interviews with nurses who are experts in the clinical area. According to Marks (1987) data collection is best attended by a nurse who is familiar with how nurses organise their work. O'Brien (1986) supported this concept, termed it professional intuitive judgement, and believed it to be the most appropriate method used in the assignment of staffing levels. Strida and Andrews (1989) supported the concepts put forward by O'Brien and Marks (1987). Fawcett (1985) made the point that nurses are trusted to make vital decisions about patients in their care, so therefore should be trusted to make reasoned assessments of staffing needs. In England, Waite and Hirsh tested the theory of expert judgement and reported their findings in 1986. These authors asked for the judgement of nurses at the end of particular days over several months, rather than in general. They then tested the reliability of this judgement with dependency methods used in other areas and reported general agreement.

2.7 Direct and Indirect Care

An area of contention evident in the literature related to the development and use of patient classification systems is the inconsistency in the definition of direct care and indirect care. Whether non direct activities (away from the patient) vary in proportion to direct care activities for the same patient is not clear. In theory, the total care given to a patient on a hospital unit could be quantified by measuring all the direct and indirect care activities specific to that person. This would include the planning reporting, preparations for care, communications,

record keeping and similar activities in addition to bedside care. In practice, however, measurement of total care for a specific patient is difficult because so many activities away from the patients bedside are mixed with those referable to other patients and to unit management tasks.

Williams (1983) commented that direct care was commonly referred to in such terms as direct care requirements, direct care needs or patient demands for direct care. Such terms could be considered meaningless because they defy measurement. The care received may be required on some other basis than patient need, and patient needs may really be expectations. Huckabay (1988) pointed out that different authors had differing definitions of indirect care and included differing aspects in their patient classification tool. The literature supports that some authors have defined indirect care as those aspects of patient care carried out away from the patients bedside but on his or her behalf and for his or her welfare. Others have included activities performed at departmental or administrative levels, such as administration, recruitment, staff education and orientation. Connor (1961) in his research considered preparation and completion of direct care, paperwork and communication as indirect care. Wolfe and Young (1965) included these aspects in their research, but expanded the definition to include escorting, errands and travelling time. Fosbinder (1986) maintained the same basic components of indirect care as Connor and Wolfe and Young, with the addition of reporting. O'Brien, however, in the same year as Fosbinder included administration, teaching and supervision of junior staff as variables to be measured.

Vanputte, Sovie, Tarcinale and Stunden (1985) defined differing aspects of care in some detail. According to these authors direct care time was patient assignable and included patient centred activity which nursing personnel carry out directly with the patient and\or family. Some examples of direct care were: all hands on care; admission history and assessment; patient\family teaching; medication administration; dressings, specimen collection; group therapy; group pre\post operative teaching and health teaching to a group of new mothers. These authors defined another variable which was patient assignable, calling this Other Time. This component of Other Time included all activities which, while away from a specific patient or family, referred to or completed direct care for that patient. Some examples of Other Time were development of care plans, family\team conferences, documentation in progress notes and preparation of medications. Vanputte et al described Unit Related Time as those activities related to the entire unit's patient population, and included inservice education, committee work, and environmental safety assessments. Personal time was considered paid time spent on breaks, personal hygiene or personal errands. Unit Related Time and personal time were combined to give unit constant time. Each patient, independent of nursing acuity category, received an equal assignment of unit constant time. Total time for each patient then became the sum of the average direct and average other patient assignable time together with the unit constant time.

Dijkers and Paradise (1986) discussed direct and indirect care and considered these components a little differently. According to these authors, indirect care related to those nursing services not assignable to a particular patient or ward.

These included all nursing activities necessary to support the nursing infrastructure for the provision of nursing care. Direct care was considered as those services to a particular patient, whether it was direct or indirect. According to Dijkers and Paradise, three different methods of allocating time for indirect activities are possible: divide equally over all admissions; allocate in proportion to length of stay, or allocate in proportion to classification scores\nursing care hours received accumulated over the entire stay.

As varied as the definitions in the literature for direct and indirect care, are the times allocated for the component of indirect activities. Barham and Schneider (1980) took their estimations from data collected over a fourteen day period and suggested that 39% of nurses' activities related to indirect care. O'Brien (1986) accepted 35% of time as being spent on indirect activities over a twenty four hour period after research in the available literature at that time had offered figures of 42%, 48% and 50%. Huckabay (1988) quoted a study by Riley and Schafers where indirect component at unit level was said to be 30%. Misener, Frelin and Twist (1987) commented on work done by Lake in 1982 where nurses were reported as spending 28-35% of time in direct care activities, and between 50% and 65% attending indirect care. Personal activities or unavailability were said to account for 10-15% of nurses' time. Minyard, Wall and Turner (1986) wrote that nurses spent 32.8% of time in direct care, 26.9% in indirect care, 20.3% in unit related activities and 20.0% in personal and non-productive time. These authors went on to state that some industrial engineers suggest 16% as a reasonable figure for non-productive time. Williams (1983) suggested that standard times for procedures should be increased by 20% to allow for fatigue,

preparation, travel time, waiting time and individual variance. Hovenga (1985) in her research included a 15% allowance for tea breaks and personal time.

2.8 Patient Classification System Studies

2.8.1 Introduction

Due to the abundance of literature available regarding patient classification systems, it is not feasible to review all systems which have been developed. Therefore patient classification systems which relate to general patients will be reviewed in decades, 1960-1969, 1970-1979, and 1980 to current, and will include only those systems which were significant. Patient classification systems which relate specifically to neonatal care will be reviewed.

A summary of the literature related to patient classification systems published in 1960-1969 is presented in Table 2.3, those published in the decade 1970-1979 is presented in Table 2.4, those published in 1980 to present is shown in Table 2.5. Patient classification systems related to neonatal care are summarised in Table 2.6.

Table 2.3: Summary of Patient Classification Systems 1960-1969

Researcher	No of Classes	Method of Classification	Method Used	Client	Considerations
Connor (1961)	3	Prototype	Work sampling	General	Work carried out at Johns Hopkins. First instrument to give an estimate of nursing requirements of patients in 3 categories of direct nursing care. This study has been used as a basis for many other studies.
Wolfe and Young (1965)	3	Prototype	Work sampling	Medical Surgical Ophthalmological	Based on Connor's work. Considered direct care and all activities of indirect care. No consideration of psychosocial needs or teaching.
Barr (1967)	5	Factorial	Time Studies	Medical Surgical	A workload index was used to determine needs for nursing. Included technical, observational and emotional components of patient care requirements.

2.8.2 Patient Classification Systems 1960-1969

In the early 1960's the work carried out by Connor (1960, 1961) at Johns Hopkins Hospital in Baltimore resulted in one of the most significant studies in the area of patient classification systems. Connor's work has since been used as a basis for many other patient classification system studies. Connor selected patients based on criteria which included mobility, consciousness, emotional state, and physical attributes such as adequacy of vision. Connor's study focussed on work sampling techniques and devised three categories of patient dependency; self care, partial care and total care. Connor's system has attracted criticism due to the failure to include psychosocial needs of the patient (Abdellah and Levine 1979, Giovanetti 1979).

Wolfe and Young (1965) adapted Connor's work to provide a basis for their study. Their study utilised the technique of work sampling and included direct care and aspects of what the authors termed indirect care, such as preparation, paper work and communication. Wolfe and Young's work also resulted in the formulation of three categories of patients, namely; self care, partial care and total care. The time allocated to these categories was greater than that of Connor due to the addition of the component of indirect care.

Barr (1967) used Connor's work and the Johns Hopkins tool as the basis for his work in Britain. Barr used activity sampling and continuous patient observation during data collection. Barr's research considered the technical, observational and emotional components of patient care requirements and developed one of the first factorial tools for use with general medical and surgical patients.

Table 2.4: Summary of Patient Classification Systems 1970-1979

Researcher	No of Classes	Method of Classification	Method Used	Client	Considerations
Georgette (1970)	4	Prototype	Time studies	Medical Surgical	Adapted CASH studies to include factors to assess emotional and teaching support needed by patient.
Poland, English, Thornton and Owen (1970)	10	Factorial	Work sampling	Paediatrics	Utilised Nursing Care Units defined as one hour of physical care. No consideration of parent education in paediatric ward.
Cullen, Civeta, Briggs and Ferrara (1974)	4	Factorial	Expert opinion by medical officer and nurse	Intensive Care	Based on point system for medical diagnosis or intervention. Points are added to give patient points per nurse. The "nursing burden" was then measured in patient points. No consideration of psychosocial needs.
Barham & Schneider (1975)	4	Prototype	Expert timing by nurses	General	Recognised psychosocial interaction with patients and family and teaching of patient and family.
Chagnon, Audette, Lebrun and Tilquin (1978)	4	Factorial	Expert opinion	Paediatrics	Interventions weighted by nurse and doctor as to amount of time required to fulfil. Interventions then totalled over 24 hour period to give dependency. No allowance for teaching.

2.8.3 Patient Classification Systems 1970-1979

Cuthbert (1983) discussed the formation in 1967 of The Commission for Administrative Services in Hospitals (CASH) in California. The Commission was formed to aid hospital administrators with budget control, and established standard times for nursing procedures and activities, considering different levels of nursing personnel and skill mix. It was hypothesised by the Commission that this system could be used to calculate the workload and staffing allocation required for wards as part of manpower planning. Georgette (1970) expanded the CASH work in her study at Hollywood Presbyterian Hospital. Georgette included in her work consideration of patient teaching and emotional support among nursing activities. Georgette's work resulted in a prototype evaluation method with four patient categories.

Poland, English, Thornton and Owen (1970) reported on the PETO system (named after the authors) undertaken at Eugene Talmadge Memorial Hospital in Georgia. This study was based on work carried out at the Johns Hopkins Hospital by White in 1967, and was expanded to include paediatric patients. Work sampling method in this study resulted in a factor evaluation patient classification system based on Nursing Care Units. A Nursing Care Unit was defined as one hour of physical nursing time. Levels of intensity for a patient's care were totalled to give an estimate of actual nursing time each patient would receive. It was reported that one of the major benefits of the PETO system was it's use as a guideline for patient admission based on need and available nursing resources. Whilst the study had been expanded to include paediatric patients,

unfortunately there is no documentation of parent or patient education amongst the nursing activities.

Cullen, Civetta, Briggs and Ferrara (1974) devised the Therapeutic Intervention Scoring System (TISS) which was one of the first attempts to quantify nursing care needs in critical care areas. This study undertaken at Massachusetts General Hospital was based on expert validation by medical officers and nurses within the Intensive Care Unit. In this research, patients were categorised according to the number of medical interventions they underwent and were then allocated a (TISS) point number based on those interventions. The nursing workload was measured by the patient points although no nursing hours per patient day were related to the TISS points. The Therapeutic Intervention Scoring System has been criticised by Jackson and Resnick (1982) for the absence of consideration of time consumed for patients' psychosocial needs. Hudson, Caruthers and Lantiegne (1979) criticised Cullen for not addressing the nursing time required because of the medical interventions. Cullen's work was revised for use in two other critical care units, firstly in a cardiac care centre at Parkview Memorial Hospital, Fort Wayne Indiana, reported by Burger and Schmitt (1982), and secondly, in an intensive care unit at Gainesville Virginia, reported by Alexander, Rumley and Blikken (1984). Both of these researchers maintained the framework of Cullen's original work and failed include any variables to consider psychosocial needs of the patients.

Chagnon, Audette, Lebrun and Tilquin (1978) reported on a study undertaken over several years at the Sainte-Justine Hospital in Montreal, Canada. This study

was one of the most comprehensive at the time of publication, and considered a wide variety of nursing interventions ranging from health promotion to rehabilitation. Nursing activities required were categorised under respiration, feeding, elimination, hygiene and comfort, communication, treatments and diagnostic procedures. One important aspect of this study was the use of one hundred nurses to develop expert based timings for the interventions being reviewed. An indirect component which included communication and documentation of care planning was considered, and was added to the weighting of each intervention. This study resulted in a factorial tool with four levels of patient intensity which was used to estimate the staffing needs for the next twenty four hours.

Barham and Schneider (1980) reported the Matrix patient classification system, a study undertaken in 1975 at the thirteen medical centres of the Northern California Region of the Kaiser-Permanente Medical Care Program. In this study a committee of expert nurses spent twelve months defining patient care nursing needs. The Committee established four levels of intensity of care and determined a mean time for each element of care at the minimal skill level. This study included recognition of psychosocial needs of the patient together with education for both patients and families. The study resulted in a tool which identified each patient's needs in ten areas of direct care, namely: bed, bath, nutrition, elimination, vital and neurological signs, movement and transportation, medication, treatments, teaching and psychosocial needs. These indicators then computed to one of four levels of intensity based on the mean number of minutes required to perform the activities by the minimal nursing skill. Observational

studies were undertaken in three of the medical centres within the Kaiser-Permanente Medical Care Program by that group's industrial engineering department to determine indirect care component. This study revealed that nurses spent 58% of their time in direct care and 39% in indirect care, although definitions of direct and indirect care were not documented. The remaining 3% of time was said to be "outpatient services" Barham and Schneider (1980:26). The ratios for indirect care were allocated differently for the four levels of care; the patients requiring more intense nursing care were seen to require less indirect care. The Matrix system was one of the most comprehensive tools developed at the time of its publication.

Table 2.5: Summary of Patient Classification Systems 1980-Current

Researcher	No of Classes	Method of Classification	Method Used	Client	Considerations
Reinert and Grant (1981)	5	Factorial	National time studies	Not stated	Critical indicators of care divided into five categories. Each indicator assigned a weighted relative value based on number of minutes required by nurses to achieve tasks. Included indirect time based on observation.
Cleland (1982)	3	Prototype	Descriptive indices	Maternity	Attempted to look at skill mix and relate that to patient care.
Sovie, Tarcinale, Vanputtee and Stunden (1985)	4	Factorial		Medical, Neurology, Orthopaedic, Paediatric, Obstetric, Surgical, Psychiatric	Computerised program attempts to associate nursing classification with Diagnostic Related Groups (DRG's).
Reitz (1985)	4	Prototype	Expert opinion	Medical, Surgical Paediatric, Oncology, Psychiatric, Obstetric, Neurology, Gynaecology, Community.	Nursing intensity estimated on amount of time patient is in need of nursing care. Nursing Intensity Index applied retrospectively on discharge and examines nursing intensity with DRG's
Fosbinder (1986)	4	Factorial	Work sampling	General	System of acuity points relating to nursing intensity interfaced with DRG financial data base system.
Halloran, Patterson and Kiley (1987)	0	Patient profile		Psychiatric, Paediatric, Gynaecology,	Hand held computer system based on nursing diagnosis. Nurses are assigned a number of patients and prioritize their own time based on assessment and nursing diagnosis
Vousden (1989)	5	Factor	Activity sampling	General	Computerised acuity system based on factorial approach. Nurses enter factors of care and computer works out dependency. Patients are involved in discussions related to the amount of care they require.

2.8.4 Patient Classification Systems 1980-Current

With the advent of Diagnostic Related Groups (DRG's) and prospective payment in 1983 (Charbonneau, Ostrowski, Poehner, Lindsay, Panniers, Houghton and Albright 1988), patient classification systems began to reflect ideas on measuring nursing intensity associated with DRG and case mix management. This led some authors (Vaughan and MacLeod 1980) to suggest national standards for patient classification systems which would allow comparison of patient mix and productivity among hospitals, regions and states in The United States of America. This concept was considered questionable and impractical by Jackson and Resnick (1982) and Vanputte, Sovie, Tarcinale and Stunden (1985). These authors believed this combination of patient mix and productivity may not fairly reflect the particular situation in a given institution where time for various interventions were likely to change, based on the equipment available and the internal geography of the patient care areas.

Halloran and Kiley (1984) were among the first authors to discuss nursing information systems based on nursing diagnosis. Halloran, Patterson and Kiley (1987) expanded this concept to formulate a system where patient classification data was based on nursing diagnosis and collected by use of a hand held computer. This system was piloted in a psychiatric, paediatric, and womens' hospital and was felt to support the judgement of bedside nurses. Reider and Norton (1984) discussed computerised nursing information\acuity systems and considered the development and integration of these systems within the hospital information system as crucial.

Sovie, Tarcinale, Vanputee and Stunden (1985) reported on a study at the University of Rochester Medical Center which resulted in the development of a computerised management system which included patient classification data as a major component. The patient classification component was a factorial evaluation system with four levels of intensity and considered ward activities as part of patient acuity. This data was used to analyse the relationship of patient classification systems with DRG's and develop program budgeting systems.

Reitz (1985), in her research to develop the Nursing Intensity Index at the Johns Hopkins Hospital in Baltimore, considered the issue of nursing intensity in medical, surgical, paediatric, psychiatric, oncology, ophthalmology, obstetric, gynaecology and neurology patients. Reitz was one of the first to consider nursing theory in her research, citing the work Rogers, King, Orem and Callista Roy as meaningful. In Reitz' study two independent groups of 15 nurse experts were established, one group included clinicians and educators, the other group consisted of administrators. The function of these groups was to determine elements of nursing practice which described and contributed to nursing intensity. Eleven health parameters were defined in two primary health dimensions, biophysical health and behavioural health. These groups of experts developed descriptors of nursing associated with each of the eleven functional health parameters according to a four category prototype classification scheme. The system developed integrated the scores assigned for each of the health parameters and rated the patients from one (low) as minor nursing resource required to four (high) extreme nursing resources required. The Nursing Intensity Index was applied retrospectively on discharge, as an indication of the intensity of care

required by the patient during hospitalisation. This was not a patient classification system which could be used for day to day staffing determinations, Reitz was more concerned with building a model for setting standards for nurse staffing and cost allocation. Reitz argued that The Nursing Intensity Index, when combined with DRG's would allow accumulation of data on homogenous patient groups for case mix. Bost and Lawler (1989) reported on a trial of Reitz's Nursing Intensity Index in a 350 bed rural hospital in Northern Carolina and found advantages in using the Nursing Intensity Index in that hospital. These authors commented favourably on the use of nursing theory in the development of the Nursing Intensity Index.

Reinert and Grant (1983) discussed a patient classification system study undertaken at St. Lukes Medical Centre in Denver, Colorado. At this centre a prototype evaluation system had been in use for ten years, but the management of this hospital considered that system subjective, and felt that caregivers manipulated the classifications to obtain additional nursing staff. The authors reported on a study undertaken to devise and implement a factor evaluation classification system. A committee of nurses was established to identify the critical indicators which formed the basis for the patient classification system. The Committee isolated 30 patient indicators, and then divided these indicators into five major categories: activities of daily living; treatments; medications; monitoring; and teaching and counselling. Each indicator was assigned a value based on the number of minutes required (determined by activity sampling) by the nursing staff to accomplish the specific item. Indirect activities were included and were added to the calculated direct care timings to devise the

standard hours per patient day. Nurses completed the patient classification form two hours prior to the end of each shift and the staffing office computed this information and assigned staff for oncoming shifts. The authors reported satisfaction with this approach because "this system enables nursing staff and administration to accurately appraise patient acuity and objectively project staffing needs while reducing costs and minimising paperwork" (p21).

Cleland (1982) discussed a patient classification system which looked at the needs of maternity patients and newborn babies. This method used descriptive indices and divided patients into three levels of care. Nursing needs were assessed with regard to five dimensions, namely; teaching, counselling, physical care, technical observation, and advanced clinical observation. The total score of the five dimensions were estimated. Patients were classified as needing Level I, "low risk", Level II, "average risk" or Level III, "high risk" care. The researchers also attempted to determine levels and skill mix of nurses required to care for patients. Cleland attempted to account for all nursing costs and relate these to hours per patient day. Nursing care hours were considered to be the number of hours per patient given in direct care, while total hours of care were the number of hours per patient worked by the entire nursing unit staff during a 24 hour period. Hours worked by registered nurses, licensed practical nurses, charge nurses, ward clerks and other ancillary workers were added and the total hours and divided by the patient census to give total hours\patient day. This method demonstrated one approach to accounting for the indirect administrative component of care.

Fosbinder (1986) discussed a patient classification system which quantified nursing intensity, or acuity level, interfaced with a Diagnostic Related Group (DRG) financial data base system, resulting in a average nursing cost per patient and DRG. A 158 bed acute care facility in San Diego was the study site for Fosbinder's work, which resulted in the development of a factor evaluation tool. The underlying premise for Fosbinder's system was that variation in the intensity of nursing activities could be defined, measured and converted to time standards, and that time standards converted to dollars or the ultimate cost of providing nursing care. According to Fosbinder, identifying the actual cost of nursing care was consistent with the initial intent of the DRG system, however during development of the DRG system, a price was assigned to each DRG based on historical data of all resources required to care for patients during specified illness, surgery or investigations. The variability of nursing resources associated with each DRG was not captured because all nursing costs were calculated in the room rate. Fosbinder argued that although the predictors of nursing resource use could be similar, if not identical, to the factors that defined DRG categories, a nurses' workload may have as much to do with circumstances as with a specific disease or treatment. Factors such as the patients age, knowledge of illness, expectations for care, emotional status and family support appeared to strongly influence the amount and type of nursing intervention required. To determine the cost of nursing Fosbinder used several methods. The total hours for each patient were multiplied by the average hourly salary of the clinical nurses, while unit fixed costs were calculated by multiplying the length of stay by the average salary of the fixed unit staff such as the head nurse, unit clerk, monitor technician and escort. Central nursing administration and nursing education

numbers were also calculated and proportioned to determine a total average nursing cost for each patient. This particular method of adding unit fixed and hospital\department fixed cost to patient care was similar to that of Cleland, however Fosbinder's approach is more detailed.

Vousden (1989) discussed a computerised acuity system which was instituted as part of a total nurse management system at Freeman's Hospital, Newcastle in Britain. The system was a way of measuring patient dependency and workload levels based on interviews with the patients. This collaborative approach between nurse and patient resulted in care planning which was not merely the nurses' observations and views, but considered the patient's own estimation of needs for assistance and care. The basis for the acuity measurement of the system was an activity analysis carried out by nurses for a 24 hour period for one week. The study resulted in five dependency levels ranging from independence to the requirement for assistance of two nurses, based on personal care, ability to feed, mobility and nursing intervention. Once the categorisations were made, the computer calculated the dependency level of each patient. Unfortunately these authors did not discuss how or whether indirect activities were considered as part of the acuity\staff management. The authors reported a level between 65-70% accuracy between planned and delivered care, but did not comment on the significance of this finding. As part of quality assurance associated with this system, patient questionnaires were used to measure the perceived quality of care.

Several computerised systems are now available in the United States of America, which combine care planning with acuity and staffing. Adams (1986) discussed the Spectra Medical Information System. The basis of this system was a plan of care from which an acuity index and calculations of staffing needs was a by-product. On the Spectra Medical Information System nurses selected nursing diagnosis, nursing care goals and desired patient outcomes which was presented as a detailed patient care plan. The software program calculated the acuity according to minutes of nursing care from the care plan. Direct and indirect nursing activities were included. The acuity system consisted of point values, derived from time standards based on nursing care tasks and activities. Calculation of acuity was based on one point per one minute of nursing time, thus facilitating calculation of staffing and budget. The computer program calculated the percentage of tasks to be performed by professional and para professional staff as well as the percentage of these staff according to shifts, resulting in a projected staffing pattern for each shift.

Table 2.6: Summary of Neonatal Patient Classification Systems

Researcher	No of Classes	Method of Classification	Technique Used	Considerations
Reynolds, Barry and Rowley (1984)	0	Factorial	Activity sampling	Modified Cullen's Therapeutic Intervention Scoring System for neonatal care. No consideration for psychosocial needs.
Campbell (1990)	7	Prototype	Activity sampling	Quick and easy to use, however the categories designated are in some instances ambiguous which reduces the tool's effectiveness.
Battersby and Hemmings (1990)	0	Factorial	Activity sampling	One of the first attempts to devise a patient classification system specifically for neonatal care. The tool is more suited to Neonatal Intensive Care Units rather than neonatal care in general.

2.8.5 Patient Classification Systems for Neonatal Care

Reynolds, Barry and Rowley (1984) in a paper presented to the Australian Perinatal Society Annual Congress reported on an adaptation of Cullen's Therapeutic Intervention Scoring System for use in the Neonatal Intensive Care Unit at the Newcastle Mater Misericordiae Hospital in N.S.W. This work maintained the same contextual framework as Cullen's original work and offered no consideration for psychosocial needs.

Campbell (1990), in a paper presented to the Association of Neonatal Nurses of N.S.W. annual seminar reported on her research to devise a patient classification system for intensive and special care nurseries at the Royal Women's Hospital in Melbourne. Campbell's research utilised modified activity sampling techniques to devise a prototype evaluation tool with seven categories to denote intensity of need. The nursing hours per patient day (NHPPD) for each of the seven categories are illustrated below (see Table 2.7).

Table 2.7: Nursing Hours Per Patient Day for Neonatal Units - Campbell (1990)

Category	Nursing Hours Per Patient Day
A	5.0
B	6.0
C	8.0
D	12.0
E	14.0
F	18.0
G	27.6

Campbell's patient classification system was quick and easy to use, however the categories designated are in some instances ambiguous which reduces the tool's effectiveness.

In 1990 Battersby, Hemmings and Mahon at the Charles Sturt University in N.S.W. were commissioned by the N.S.W. Department of Health to devise a patient classification system for neonatal nursing. This study was reported in 1991. Battersby's study was carried out in three neonatal intensive care units in hospitals in N.S.W. Battersby's work was based on critical indicators of care, using activity sampling method to gain average timings for nursing interventions. The research resulted in the formulation of a factor evaluation tool which used a computerised barcode software package to determine the intensity of care required for babies within a neonatal intensive care unit. The work by Battersby et al was one of the first attempts to devise a patient classification system specifically for neonatal care, however the resulting tool was more suited to Neonatal Intensive Care Units rather than neonatal care in general.

2.9 Necessary Components of Patient Classification Systems

In 1989 De Groot stated that many existing patient classification systems had fallen short of expectations in regard to the information generated, and that this impacted directly on the management decisions able to be made based on the information. De Groot attributed what she perceived as failings to a lack of appreciation for the basic components of patient classification tools. De Groot

detailed the essential elements of a patient classification system, stating that an effective patient classification system must; predict nursing care requirements for individual patients, validate the amount of care give to each category or type of patient on each unit and shift, and relate nursing care requirements to staff resource allocation on a shift by shift and unit by unit basis. In 1985 McGratty made similar comments, and pointed out that systems which match nursing resources to workload must be predictive. McGratty also stated that the system must be easy and quick for the nurses to operate and flexible enough to reflect daily fluctuations in case mix and patient movement. McGratty's comments were supported by Nagaprasanna (1988) who commented specifically that ease of use of the classification system was one of the most important considerations.

Cuthbert (1983) was specific in her definition of the necessary components of a patient classification system. To Cuthbert, the major considerations of a patient classification system must be: simplicity of use, unambiguous criteria for classification, acceptability to nursing staff, inclusion of psycho-social and educational requirements of patients and relatives, the ease of monitoring to ensure accuracy, prediction of nursing personnel for short and long-term rostering, allocation of staff according to skills required for each shift, and use in controlling elective admissions.

All of these authors supported the view put forward by Huckabay and Skonieczny in 1981 who stated that the impact of a patient classification system scheme depends on fundamental factors. These authors included in those factors

a sense of control over the system by the users, adaptability to most clinical areas, and acceptance of the system by hospital administration.

2.10 Validity and Reliability of Patient Classification Systems

Giovanetti (1979) pointed out that the issues of reliability and validity of patient classification systems were extremely important. As with any instrument or measuring device, some estimate of both reliability and validity must be established before the instrument can be used with confidence.

Giovanetti stated that reliability referred to the consistency of the measurement instrument and reported that three major types of reliability could be distinguished: measures of stability, homogeneity, and equivalence. Giovanetti held the view that due to the nature of patient classification instruments, measures of equivalence represented the most important estimate of reliability. Equivalence referred to the extent to which different investigators using one instrument to measure the same individual at the same time, or different instruments applied to the same individual at the same time, yielded consistency. When one instrument is being used by different individuals, the method of reliability most commonly applied, according to Giovanetti, was interrater reliability. This terminology referred to the result of comparisons between two or more persons classifying the same patient at the same time. Giovanetti stated that if the patient classification system is to be used to determine the number of

nurses required, and to provide information about fluctuations in staffing requirements, confidence in interrater reliability must be assured.

Giovanetti put forward the view that the three most common types of validity; content, criterion-related, and construct, are each associated with the major purpose of the patient classification instrument, that is, determination of nursing care time. She pointed out that content and criterion-related validity are important to patient classification, construct validity is of less importance. Giovanetti commented that content validity referred to the classification systems ability to adequately represent the domain it is supposed to measure, the patients' requirements for nursing care time. Content validity has no empirical basis and relied generally on judgement. The usual procedure being to present the criteria for classification to a panel of nurse experts who systematically examine the criteria to assure that these criteria were representative of a specified content. According to Giovanetti, criterion-related validity referred to the extent to which the instrument corresponded to some other observation that accurately measured the subject being studied. This may be concurrent or predictive. Concurrent validity was established by comparing the classification instrument with another instrument designed for the same purpose. This type of validity is open for question, because it is difficult to accept the premise that one classification instrument is valid in other settings. Predictive validity is established by comparing classification results with findings from observational studies of the nursing care actually provided. As the major purpose of a patient classification instrument is the determination of nursing personnel time, evidence of predictive validity becomes important. Giovanetti emphasised that having obtained validity,

patient classification instruments must be surveyed on a regular basis to ensure that they continued to function in the manner intended. Giovanetti's writings on the issues of reliability and validity have been supported by Gallagher (1987).

2.11 Implementation of Patient Classification Systems

According to Giovanetti and Mayer (1984) a well designed educational program is crucial to the implementation and correct use of a patient classification system. Education must be directed at the nurses who are responsible for classifying patients, management personnel who must understand the system and educators who may be required to teach the system to new staff.

Giovanetti and Mayer (1984) stated that the first objective is to establish the place of the patient classification system within the framework of the hospital's commitment to patient care. Users of patient classification systems may not see that such systems link the standards of care planned to be delivered with the care actually provided. The second objective, according to Giovanetti and Mayer (1984), was to develop specific skills for classifying patients among the nurses who would be responsible for such decisions. These authors commented that reliability of the patient classification system must be tested frequently, and policies to establish reliability monitoring established as part of the overall implementation plan. Giovanetti and Mayer (1984) pointed out that maintenance mechanisms and survival strategies were crucial to long term effectiveness of a patient classification system. If acceptance and confidence diminishes, individual nurses may manipulate the system for their own interest or cease to make

decisions in terms of it. Systematic continuing education and regular monitoring for reliability and validity establish and reinforce nurses' commitments to patient classification as well as their skills in applying its process. Giovanetti and Mayer's (1984) theories on the implementation of patient classification system were supported by Poulson (1987).

2.12 Summary

In 1983 Williams pointed out that patient classification systems to date did not measure the essential elements of nursing practice. Haas (1988) supported this, stating that patient classification systems described nursing as the performance of a mindless series of predominantly physical care activities. Jennings, Rea, Antopol and Carty (1989) argued that nursing is not a simple sum of discrete tasks with specific points of beginning and end, while Halloran, Patterson and Kiley (1987) wrote that nursing is as much an intellectual endeavour as it is a physical one.

In the past, patient classification systems have focussed on that part of nursing which is able to be seen and therefore most amenable to measurement. Vast differences in what has been defined as direct and indirect care have been noted. The methods often employed to measure nursing have been industrial engineering or management engineering techniques. This form of measurement could be considered mechanistic and reductionist, because it focuses on the doing aspects, failing to measure the assessment, planning, evaluation or caring features of nursing practice. While some industries may be amenable to industrial

engineering techniques, it could be argued that the method is not suited to the human sciences including nursing. Niemeier and Reed (1985) pointed out that traditional scheduling patterns based on fixed hours of care often resulted in inadequate staffing levels, minimal nursing care standards, excessive use of overtime, low morale, and high turnover among nurses. Haas (1988) considered that construction of a patient classification tool needed to be grounded in a theory or theories which explain the work of nursing.

Neonatal units have for many years supported a medical model and nursing's adaptation to a medical model. Nursing resource allocation has been based on diagnosis and\or medical interventions, rather than on a nursing model. Nursing care administered is grounded in the philosophy of the unit and is based on assessed patient need, therefore patient assessment is the crucial step in determining care requirements and therefore resource allocation. In this research it is intended to investigate the notion that resource allocation must be based on a model which all considers nursing practice, including theory based nursing practice, care practices required because of medical interventions, psychosocial care and education, rather than adaptation to a medical model. A patient classification system based on a theoretical nursing model will be developed.

CHAPTER THREE

RESEARCH DESIGN, PILOT STUDY AND VALIDITY ESTIMATES

CHAPTER 3: RESEARCH DESIGN, PILOT STUDY AND VALIDITY ESTIMATES

3.1 Introduction

In this section the research design of the study and the development of the data collection tools will be outlined. The pilot study will be discussed and the validity estimates described.

3.2 Research Design

3.2.1 Introduction

The main area for examination in the research was the time taken for direct and indirect care giving activities attended by nurses in a neonatal unit. Observer timed recordings (activity sampling method) of nursing activities were attended to determine the length of time required for a variety of direct care nursing activities. Work sampling method was applied in the observation and recording of indirect care nursing activities. Expert nurse judgement was obtained to determine validity of the data collected through activity sampling method.

3.2.2 Activity Sampling Method

Activity sampling method consists of making regular intermittent observations of the patients and documenting the nursing activity being performed (Cuthbert 1983:60). Activity sampling method is based on the laws of probability and assumes that from a sample of employee activities, generalisations can be made

about those activities (Williams 1983; Hagerty Cheng and Spengler 1985). A high degree of accuracy in determining data has been accepted from this method (Williams 1983; Hagerty Cheng and Spengler 1985). Activity sampling method was applied in this research in the observation and recording of time taken for direct care activities.

3.2.3 Work Sampling Method

Work sampling method, described as "minute by minute observation of nursing personnel" by Cuthbert (1983:60) consists of the selection of one individual nurse and the documentation of each aspect of care performed by that nurse during her shift. Work sampling method was applied in this research in the observation and recording of time taken for indirect care activities.

3.2.4 Expert Nurse Judgement

Nurses expert in the field of neonatal nursing were asked to give their assessment of the time taken to attend frequently occurring direct care activities. This information was obtained to determine validity for the data collected through activity sampling method. Giovanetti and Mayer in 1984 recommended that expert judgement be used in validating patient classification system data. Waite and Hirsh (1986), O'Brien (1986), Marks (1987) and Strida and Andrews (1989) commented that interviews with nurses working in the area being examined would provide reliable data for use with staff scheduling.

3.2.5 Summary

The main area for examination in this research was the time taken for direct and indirect care giving activities attended by nurses in a neonatal unit. Activity sampling and work sampling method of data collection have been explained and the use of expert nurse judgement for validation purposes has been discussed.

3.3 Development of the Instruments

3.3.1 Introduction

Three instruments were developed for data collection. These will be described in the following sub-sections.

3.3.2 Nursing Intervention Tool

The Nursing Intervention Tool (N.I.T.) was designed to be used in activity sampling of a variety of individual direct care nursing interventions within the neonatal unit. The N.I.T. (see Appendix 1) was designed to record each nursing intervention inclusive of: preparation for the intervention; undertaking the intervention; post intervention phase; documentation of the intervention and assistance required for the intervention. Preparation for the intervention would include obtaining the necessary equipment and pre-intervention hygiene. Undertaking the intervention represented the hands-on undertaking of the intervention. Post intervention phase would include disposal of used equipment and necessary hygiene. Documentation included notation on bedside charts or

case notes. Assistance required related to the need for a second nurse for completion of the activity.

The Nursing Intervention Tool was also designed to attempt to capture documentation of caring\supportive aspects such as soothing\settling activities attended during the intervention, together with an explanation of the procedure to the parents. Neonates are pre-vocal and explanation of procedures cannot be offered to them in the same way as adult patients. It was the belief of the researcher that the time taken for nursing interventions may be increased due to the need to soothe and pacify the neonate after interventions and painful procedures. In addition, an explanation of the procedure about to be attended cannot be offered to the neonate so must be given to the parents when they are present.

It was expected that use of the N.I.T. would provide data on the time taken to attend individual interventions. Several attendances of the one intervention could then be compared and appropriate statistical analysis attended.

3.3.3 Indirect Activity Tool

The Indirect Activity Tool (I.N.D.A.T.) was designed to be used in a work sampling context to determine indirect nursing activities attended by registered nurses within the neonatal unit (see Appendix 3). The tool was designed to document the various indirect activities attended and the time taken to complete these. The I.N.D.A.T. was designed to be used for the duration of an eight hour

shift to record the total activities of the individual nurse during that period. The tool was designed to: record commencement and completion times of each individual activity, documenting the total time of each activity and to differentiate between nursing and non-nursing related activities.

It was expected that use of the I.N.D.A.T. would allow assessment of those indirect activities which are necessary and nursing related but do not involve direct interaction with any individual patient. Comparison and appropriate statistical analysis could then be attended.

3.3.4 Expert Nurses' Assessment Tool

The Expert Nurses' Assessment Tool (E.N.A.T.) was designed to record the judgement of individual expert nurses related to the time required for direct care nursing interventions. The Tool was designed to record these assessments in total, from preparation to completion, inclusive of the need for an assistant as necessary (see Appendix 4). The E.N.A.T. was designed to be used in an interview setting and in conjunction with a structured format of questions (see Appendix 5). It was expected that use of the E.N.A.T. would provide data based on the experience of expert neonatal nurses which could be compared with observer attended timings to provide validation of the data collected through activity sampling method.

3.3.5 Summary

Three instruments were developed for data collection in the study. The purpose of each of the individual instruments has been discussed.

3.4 Pilot Study

3.4.1 Introduction

A pilot study was carried out in the clinical setting to determine reliability of the two tools (Nursing Intervention Tool and Indirect Activity Tool) used in activity sampling method and work sampling method of data collection. A pilot study to determine reliability of the Expert Nurses' Assessment Tool used for data collection of expert nurses' judgement was also attended.

3.4.2 Activity Sampling Method

Permission was sought and granted from Hospital A to attend a pilot study in the clinical area to determine reliability of the Nursing Intervention Tool used for activity sampling method of data collection of direct care nursing interventions. Over an eight hour observation period twenty individual nursing interventions were observed and documented.

3.4.3 Work Sampling Method

A pilot study to establish reliability of the Indirect Activity Tool (I.N.D.A.T.) as a data collection tool for work sampling method of data collection for indirect activities was undertaken. The researcher attended the neonatal unit over three

separate eight hour shifts and observed the activities on one individual nurse for the duration of the shift. All activities, from commencement to completion, which did not include hands on nursing were recorded.

3.4.4 Expert Nurses' Judgement

A pilot study was undertaken to determine the reliability of the Expert Nurses' Assessment Tool and the structured format of questions used in obtaining the expert judgement of nurses related to direct care nursing interventions. Three expert nurses (Clinical Nurse Specialists) were approached and consented to take part in this part of the pilot study. These expert nurses were interviewed individually and asked to offer their assessment of time required for fifteen commonly attended nursing interventions.

3.4.5 Summary

Pilot studies were attended to determine reliability of the three tools used for data collection in this research. The results of the pilot studies will be discussed in the following section.

3.5 Results of the Pilot Study

3.5.1 Introduction

Results of pilot studies attended using the three data collection tools will be discussed in the following subsections.

3.5.2 Activity Sampling Method

The pilot study using the Nursing Intervention Tool (N.I.T.) illustrated that the separation of the instrument into preparation, undertaking the intervention, post intervention phase and documentation was unrealistic. In some interventions there was no preparatory phase (for example, observations). In other instances documentation took no more than fifteen seconds. It was observed during the pilot study that nursing interventions are often interrupted to attend other activities such as responding to monitor alarms and answering the telephone. The N.I.T. had no inclusion to document those occurrences which could interrupt the nursing intervention.

The pilot study also illustrated that consideration of caring\supportive aspects during the intervention as a separate measurable variable was not possible. It was observed that nurses attended soothing activities throughout, and as part of, the procedure. It was therefore accepted that this necessary part of nursing care should be considered part of the individual nursing intervention in the recording of the data. It was noted that explanation of nursing interventions and\or supportive communication with the parents were attended during the intervention if the parents were present. It was considered that these aspects were approximate to any explanation of procedure given to any patient and were therefore considered as part of the total nursing intervention. Discussions with parents regarding progress of their neonate were attended as a separate entity when the parents presented and were not associated with a direct care nursing

intervention, therefore it was accepted that these separate interludes would be considered as an indirect component of care.

As a result of observations during the pilot study, the N.I.T. was redesigned to consider one recording for the total intervention and one recording for an assistant which could then be combined to provide a recording for the total time of the intervention. An area was included to record activities external to the intervention to ensure accuracy of the timing. Areas to record caring\supportive activities were deleted (see Appendix 2). A second pilot study was undertaken using the revised Nursing Intervention Tool. Activity sampling of twenty nursing interventions was undertaken over an eight hour observation period. This pilot study of the revised Nursing Intervention Tool indicated that the N.I.T. was appropriate for the data collection required.

3.5.3 Work Sampling Method

The pilot study of work sampling method using the Indirect Activity Tool indicated that the I.N.D.A.T. was appropriate for the data collection required.

3.5.4 Expert Nurses' Judgement

The pilot study to determine the reliability of the Expert Nurses' Assessment Tool for data collection of nurses judgement indicated that the Expert Nurses' Assessment Tool (E.N.A.T.) and the structured format for questions were appropriate for the data collection required.

3.5.5 Summary

Pilot studies of the three tools used in the three methods of data collection, the Nursing Intervention Tool, the Indirect Activity Tool and Expert Nurses' Assessment Tool were attended. Revisions to the data collection tools were made where necessary and additional pilot studies attended using the revised tools. It was then accepted that these tools were reliable for the data collection required.

3.6 Validity Estimates

3.6.1 Introduction

Differing methods were used to investigate validity of the various aspects of the study. These will be discussed in the following sub-sections.

3.6.2 Content Validity of Data Collection Tools

The method used to investigate content validity of the data collection tools has been discussed in Section 3.5. These validation studies indicated that the tools used for data collection were reliable for the data collection required.

3.6.3 Validation of the Researcher's Observation and Documentation

Studies were attended by the researcher and an independent observer to determine the validity of the data observed and recorded by the researcher using activity sampling and work sampling methods. The Nursing Intervention Tool (see Appendix 2) was used for this validity estimate. Activity sampling method was

employed to document timings of eleven nursing interventions attended during a six hour observation period. The interventions were observed and recorded independently by the researcher and the observer and comparison was attended at the completion of the observation period. On three occasions there was a difference of one minute between the timings, the remaining eight occasions showed no difference between the two observers (see Appendix 6). The Pearson Product Moment Correlation Coefficient Test was applied to the two sets of data documented by the researcher and the observer, $r = 0.997$ indicating a correlation between the two sets of data. This indicated that the researcher's timing technique was valid and that data collection would be accurate.

3.6.4 Reliability of Expert Nurses' Judgement

The intra-rater reliability of the sixteen expert nurses was tested by applying the Kendall coefficient of concordance, $W = 0.972$, which indicated that the data collected from the expert nurses was reliable to be used for validation of data collected by activity sampling method.

3.6.5 Summary

Differing methods were used to investigate validity of the various aspects of the study have been discussed. Validity of research instruments, data collection techniques and the expert nurses' judgement has been determined by the methods explained in this section.

3.7 Summary

The research design of the study and the development of the research instruments has been explained. The pilot study and validity estimates have been discussed.

CHAPTER FOUR

METHOD

CHAPTER 4: METHOD

4.1 Introduction

A variety of research methods were employed to gather data for the study. Firstly, activity sampling method was employed to determine the length of time registered nurses took to complete individual direct care nursing interventions. Direct care nursing interventions observed in the study are discussed in section 4.2.1.1.

Secondly, work sampling method was employed to determine the time spent by registered nurses in indirect nursing activities during an eight hour shift. Indirect nursing activities are discussed in section 4.2.1.2.

Thirdly, a structured approach was employed (see Appendix 5) to elicit the judgement of expert nurses regarding the length of time required to undertake a variety of direct care nursing interventions. This aspect of the research constituted the main part of the study.

4.2 Research Design

4.2.1 Variables for Investigation

The two variables for investigation were direct nursing care interventions and indirect nursing activities attended by clinical nurses. These are discussed in the following subsections.

4.2.1.1 Direct Care Nursing Interventions

Direct care nursing interventions were considered to be those activities where the nurse was directly involved in attending care giving activities for the patient. These activities were considered in groups related to the basis for these activities, these groups are outlined below:

4.2.1.1.1 Observation and Monitoring

These nursing interventions included observation of vital signs and assessment of clinical parameters including blood gas analysis, blood sugar estimation and monitoring of weight gain or loss. Admission to the neonatal unit was included in this group because of the nursing assessment involved.

4.2.1.1.2 Nutrition and Fluid Management

This category included the administration of enteral feeding and management of parenteral fluid therapy. Activities where the nurse assisted a medical officer to enable parenteral fluid therapy such as insertion of cannulas or catheters was included. Activities related to the cessation of parenteral fluid therapy, such as removal of catheters were also included.

4.2.1.1.3 Hygiene, Comfort and General Care

Included in this category were personal hygiene activities including bathing, eye, oral, tracheal and perineal toilets. Interventions designed to settle and make the neonate comfortable were also included. Environmental hygiene activities necessary for respiratory therapy were considered part of this group.

4.2.1.1.4 Therapeutic and Diagnostic Interventions

Therapeutic and diagnostic intervention were considered to be medically prescribed and nurse attended or medically prescribed and nurse assisted. These activities included administration of medications, attending dressings, extubation and assisting with intubation, diagnostic ultrasound or X-Ray.

4.2.1.1.5 Parental Education

Education was separated into two categories, namely parentcraft education and education for assisting with care. Parentcraft activities included bathing, feeding, management of oxygen therapy together with the management of surgical interventions such as colostomy. Education to enable the parents to assist with care included eye, oral and umbilical hygiene and nappy change. Discharge from the neonatal unit was included in this category because of the parent interaction necessary.

4.2.1.2 Indirect Nursing Activities

Indirect activities were considered to be those activities which relate to nursing care of the patients individually or collectively but do not include physical interaction with the patient. These activities include nursing and medical rounds, discussions with parents, preceptoring other staff, and environmental safety monitoring and maintenance.

4.3 Selection of Subjects

4.3.1 Introduction

In this section the location of the study will be stated and the registered nurse population described.

4.3.2 Location of the Study

The study was undertaken in two neonatal units in two hospitals in New South Wales. Hospital A was a perinatal hospital, the majority of the neonatal client population being born within that hospital. The neonates were in the care of a neonatologist, with the emphasis being on medical management rather than surgical intervention. Nursing care was generally orientated toward support during the disease process and facilitating normal developmental processes. Hospital B was a designated childrens' hospital with no maternity services, all neonates had been transferred to this facility after birth. The main focus of Hospital B was surgical intervention and management, together with management of complex multisystem disorders. Nursing care was generally orientated towards pre and post operative management, and facilitating adaptation to surgically derived changes in function or appearance. Both neonatal units comprised intensive care (Level 3) and special care (Level 2) facilities. Each unit had a nursing policy manual which documented nursing responsibilities and guidelines for practice. Nursing philosophy and practice were similar in both units. Supernumary Nursing Unit Managers were rostered in charge of each shift to

focus on administration and management of the unit. Support systems such as clerical staff and ward assistants were similar and in place in both units.

4.3.3 Registered Nurse Population

Fifty nine nurses comprised the total registered nurse population for the study. The nurses were chosen randomly according to their availability. A complete explanation of the method and purpose of the study was given to registered nurses when their participation in the study was requested. Nurses involved in the study were asked to sign a consent form (See Appendix 7) prior to being observed. One nurse approached refused consent, but no nurse requested to be removed from the study during data collection. Of the nurses involved in the study, 25 (42%) had achieved clinical nurse specialist (C.N.S.) status while the remaining 34 (58%) were registered nurses (R.N.). Students undertaking midwifery or neonatal intensive care nursing programs were not included in the study, however no other distinction was made in relation to the level of experience in the 34 registered nurses. Of the fifty nine subjects, two were male. Table 4.1 illustrates the registered nurse population in the study.

Table 4.1: Registered Nurse Population in the Study

Hospital	C.N.S. N.	R.N. N.	Total N.
Hospital A	19	19	38
Hospital B	6	15	21
Total	**25**	**34**	**59**

As illustrated in Table 4.1, the ratio of Clinical Nurse Specialists to registered nurses in Hospital A was evenly distributed (N=19). In Hospital B, the majority of nurses observed (N=15) were R.N.'s while Clinical Nurse Specialists accounted for the remaining six in the total nurse population studied within that Hospital.

4.4 Research Instrument

4.4.1 Introduction

Three instruments were utilised to gather data for the study. The development of these instruments has been discussed in Chapter 3 and will be precised the following sub-sections.

4.4.2 Nursing Intervention Tool (N.I.T.)

The Nursing Intervention Tool (N.I.T.) (see Appendix 2) was devised for activity sampling method. The N.I.T. was designed to document the time taken for individual direct care nursing interventions, inclusive of preparation, attendance and documentation. The N.I.T. was designed to document the time taken by the primary care giving nurse, together with the assistance of any other registered nurse. The experience level of the primary care nurse (Clinical Nurse Specialist or registered nurse) was provided for in the documentation, together with the location where the intervention was attended. either the Intensive Care (Level 3) or Special Care (Level 2) Area. Provision was made to record any activities which interrupted the intervention to ensure accurate times for each intervention.

4.4.3 Indirect Activity Tool (I.N.D.A.T.)

The Indirect Activity Tool (I.N.D.A.T.) (see Appendix 3) was devised for work sampling method. The I.N.D.A.T. was designed to document all activities of one individual nurse for a complete shift. The experience level of the observed nurse (Clinical Nurse Specialist or registered nurse) was allowed for in the documentation. Provision was also made to document the location where the observation was undertaken, either Intensive Care (Level 3) or Special Care (Level 2) Area. A code was included to differentiate nursing and non-nursing activities.

4.4.4 Expert Nurse's Assessment Tool (E.N.A.T.)

The Expert Nurse's Assessment Tool (Appendix 4) was developed to document the expert nurses' judgement of the time required for individual direct care nursing interventions. The E.N.A.T. was designed to record the total time for the intervention, no differentiation was made for preparation, documentation, or for the inclusion of any assistant required. The E.N.A.T. was used in conjunction with an explanation of this part of the research and a structured question approach (see Appendix 5) to determine the judgements.

4.5 Data Collection and Recording

4.5.1 Introduction

In this section the methods used for data collection and recording are shown.

4.5.2 Method: Activity Sampling

The Nursing Intervention Tool was used for activity sampling method data collection of individual direct care nursing interventions. All registered nurses involved in the study were approached individually and asked to sign a consent form (See Appendix 7) prior to involvement in the study. A complete explanation of the method and purpose of the study was given prior to consent being sought.

During activity sampling data collection, the researcher was situated in one area of the neonatal unit and observed consenting nurses in their care giving activities for set periods of time. Observational periods were in both Level 3 (Intensive Care) and Level 2 (Special Care) sections of the neonatal units in both hospitals. Observations of interventions included any necessary preparation for the intervention, attendance, documentation, any settling activities attended at completion of the intervention and disposal of used equipment. Commencement and completion times were generally marked by hand washing activities. Interventions which were not easily observable and timed were not included in the study. A watch with a second hand was used for timing.

4.5.3 Method: Work Sampling

The Indirect Activity Tool was utilised for work sampling method of data collection of all indirect activities engaged in by one nurse for one shift. This part of the research followed the activity sampling of individual nursing interventions, and the same consenting nurses were observed. During work sampling data collection the researcher observed one individual nurse and the

activities attended during that shift. Different nurses were used on different days during data collection. Meal breaks were excluded from the observation periods. Observational periods were in both Level 3 (Intensive Care) and Level 2 (Special Care) sections of the neonatal units in both hospitals. Indirect activities were generally purposeful, each activity was easily recognisable as being attended and completed. A watch with a second hand was used to time activities.

4.5.4 Method: Expert Nurses' Judgement

The Expert Nurse's Assessment Tool was used to record estimation of time required for individual direct care nursing interventions. This part of the research was attended with Clinical Nurse Specialists. Data collection used a structured approach and was achieved through lengthy interviews with each nurse individually. The use of Clinical Nurse Specialists was based on the assumption that the education and years of experience necessary to achieve the status of expert clinical nurse would provide validity of the judgements.

4.6 Statistical Analysis

In this section the statistical analyses used to interpret the data will be outlined.

All computing was carried out by the researcher using the spreadsheet package Lotus 1-2-3, Release 2.4 (Lotus Development Corporation) and the statistical packages Minitab, Release 8 (Minitab Inc.) and Systat Version 5.0.

The use of simple descriptive statistics including the mean, the standard deviation and the coefficient of variation have been utilised in the analysis of timings of direct care nursing interventions. Similar descriptive statistics were also applied to data gathered from observations of indirect nursing activities carried out by registered nurses. Results from expert nurses' judgement of time required for nursing interventions were also examined using simple descriptive statistics. The Kendall Coefficient of Concordance was applied to the expert nurses' judgement of time required to ensure reliability of this data. The Pearson Product Moment Correlation Coefficient Test was applied to data collected through activity sampling method and the assessments of expert nurses to determine validity of the data collected through activity sampling method.

4.7 Methodological Assumptions and Limitations

4.7.1 Methodological Assumptions

The use of the mean as the measure of central tendency for analysing timings of direct care interventions and indirect activities was based on the assumption that statistically the mean is the more stable measure of central tendency (Munro, Visintainer and Page 1986:24).

The rationale for adopting the Kendall Coefficient of Concordance was its suitability for measuring the level of agreement or disagreement between judgements presented as multiple sets of data (Porkess 1899:118).

The rationale for adopting the Pearson Product Moment Correlation Coefficient was its suitability for the design of the research (Munro, Visintainer and Page 1986:64-74). Critical assumptions underlying the use of the Pearson product moment correlation to measure the relationship between the data collected by activity sampling method and the judgement of expert nurses have been adopted for the study. Firstly, that the sample is representative of the population, secondly that the variables have a normal distribution, and thirdly that the data are homoscedastic, indicating a linear relationship (Munro, Visintainer and Page 1986:64-74).

The choice of significance level was set at the conventional alpha = 0.05. the rationale for accepting alpha = 0.05 was to:

* prevent Type 1 errors which can occur by setting a too stringent level. This can cause the null hypothesis to be rejected when it is true, and
* prevent a Type 2 error, that is accepting a null hypothesis when it is false by accepting alpha = .10.

4.7.2 Limitations

As only two neonatal units were used in the study, generalisations to other populations would need to be considered with caution. Validation studies would need to be undertaken in other settings to support any findings which may be identified in this research.

4.8 Aims and Objectives of the Study

The aims and objectives of the study outlined in Chapter 1 are restated below.

4.8.1 Aim of the Study

To develop a patient classification system which may be used in staff scheduling within neonatal units.

4.8.2 Objectives of the Study

To observe nursing activities and to collect data on a variety of direct nursing care interventions within the neonatal unit.

To analyse this data by statistical means to determine average time standards for individual nursing interventions.

To observe nursing activities and to collect data on a variety of indirect nursing care interventions within the neonatal unit.

To analyse this data by statistical means to determine average time standards for individual nursing interventions.

To validate the data collected through observation methods by expert neonatal nurses judgement.

4.9 Summary

The methods used for data collection in the study have been explained. The methodological assumptions, together with the statistical analysis applied have been discussed.

The aims and objectives of the study have been restated and the limitations to the study shown.

CHAPTER FIVE

RESULTS

CHAPTER 5: RESULTS

5.1 Introduction

In this chapter the results of observation and timing of direct nursing care interventions and indirect nursing activities will be presented. Expert nurses' judgement of time required to attend nursing interventions will also be presented.

5.2 Direct Nursing Care Activities

5.2.1 Introduction

In this section direct nursing care activities observed and timed will be discussed. The total number of timings will be outlined and the numbers of observations attended in each of the sampled hospitals shown. Timings undertaken in intensive care (Level 3) and special care (Level 2) will be shown. Individual direct care nursing interventions have been categorised into groups of like activities related to the basis for the intervention as previously outlined in Section 4.2.1.1.

5.2.2 Total Direct Care Nursing Intervention Observations

Six hundred and thirty two (632) individual direct care nursing interventions were observed and timed. These observations focussed on forty three direct care interventions and was achieved during 9,799 minutes of observation in two neonatal units in separate hospitals in New South Wales. Table 5.1 illustrates the number of individual interventions observed in each hospital.

Table 5.1: Direct Care Observations: Nursing Interventions Observed in Sampled Hospitals

Hospital	Total Nursing Interventions Timed	Recorded in Minutes
Hospital A	516	7791
Hospital B	116	2008
Total	**632**	**9799**

It can be seen (see Table 5.1) that differences exist between the two hospitals where recordings were made. The individual direct care nursing interventions observed in Hospital A totalled 516, recorded in 7790 minutes, and in Hospital B consisted of 116 interventions recorded in 2008 minutes.

Direct Care nursing interventions were timed in both intensive care (Level 3) and special care (Level 2) areas in both hospitals. Table 5.2 illustrates the interventions timed in both of these areas in the sampled hospitals.

Table 5.2: Direct Care Observations: Nursing Interventions Observed in Intensive Care and Special Care Areas

Hospital	Total	Level 3	Level 2
Hospital A	516	331	185
Hospital B	116	95	21
Total	**632**	**426**	**206**

As illustrated in Table 5.2, a total of 426 observations of direct care nursing interventions were recorded in intensive care areas, 331 in Hospital A and 95 in

Hospital B. A total of 206 observations were attended in special care areas, 185 in Hospital A and 21 in Hospital B.

Clinical Nurse Specialists (C.N.S.) and Registered Nurses (R.N.) were observed randomly according to their availability for observation. As previously shown (see Table 4.1) fifty nine nurses were observed during the study, 25 of these were Clinical Nurse Specialists (nineteen in Hospital A and six in Hospital B) and 34 were registered nurses (nineteen in Hospital A and 15 in Hospital B). Table 5.3 shows the interventions observed according to nurse status in the sampled hospitals.

Table 5.3: Nursing Interventions Observed by Nurse Status

Hospital	Total	C.N.S.	R.N.
Hospital A	516	123	393
Hospital B	116	7	109
Total	**632**	**130**	**502**

Table 5.3 illustrates that 123 direct care interventions were attended by the 19 Clinical Nurse Specialists in Hospital A and 393 by the 19 registered nurses. Recordings in Hospital B show that the six C.N.S. were observed attending seven interventions and the 21 R.N.'s were recorded attending 109 interventions.

5.2.3 Categories of Direct Care Interventions

Direct care nursing interventions have been categorised into groups related to the basis for the intervention. No further delineation of those activities undertaken in Hospital A or Hospital B, or the status of the nurse, have been made. Table 5.4 illustrates these categories and the total number of direct care interventions observed in each of the determined groups.

Table 5.4: **Direct Care Observations: Categories of Direct Care Nursing Interventions**

Nursing Intervention Group	Number of Interventions	Number of Interventions Observed	Percent of Total Recordings *
Observation and Monitoring Activities	9	139	22%
Nutrition and Fluid Management Activities	12	158	25%
Hygiene, Comfort and General Care	11	178	28%
Therapeutic and Diagnostic Activities	8	107	17%
Education of Parents and Families	3	50	8%
Total	**43**	**632**	**100%**

** Percentages rounded to nearest complete number*

As shown in see Table 5.4, 22% of direct care interventions timed related to nine observation and monitoring activities while another 24% related to twelve nutrition and fluid management activities. The largest group of recordings related to the eleven hygiene, comfort and general care activities with 28% of total recordings, while the smallest group related to the three activities focusing on

education of parents and families with 8% of the total. Eight therapeutic and diagnostic activities accounted for the remaining 17% of recordings.

5.2.4 Interventions in Direct Care Categories

5.2.4.1 Introduction

In this section the results of timings of individual direct care interventions will be presented within the outlined categories. The results show the number of timings attended, the mean total time taken for the intervention and the standard deviation of the mean. The mean total time shown includes the time for any assistant required and has been corrected to exclude any activities which were attended during the intervention but did not relate to that activity (eg. answering the telephone). The percent of the total time attributable to the primary care nurse and any nurse assistant is shown. As previously discussed in Chapter 4, Section 4.3.2, hospital policy dictated nursing practice, this included the presence of an assistant nurse when attending some activities. Descriptions of the activities in each intervention for all categories are given in Appendix 8.

5.2.4.2 Observation and Monitoring

Table 5.5 illustrates the results of 139 timings of interventions relating to nine observation and monitoring activities. Complete data is shown in Appendix 9.

Table 5.5: Direct Care Observations: Observation and Monitoring Activities

Nursing Intervention	N	Mean Total Time (Minutes)	STD	Primary Nurse Percent of Time	Assistant Nurse Percent of Time
Observations - Ventilated Neonate	16	2.50	0.50	100%	
Observations - Non Ventilated Neonate	16	1.75	0.43	100%	
Blood Glucose Monitoring	16	4.00	0.71	100%	
Blood Gas Analysis - Arterial	16	6.94	1.09	100%	
Blood Gas Analysis - Peripheral	16	7.25	0.66	100%	
Weight Estimation - Ventilated Neonate	15	10.53	0.50	69.23%	30.77%
Weight Estimation - Non Ventilated Neonate	15	8.13	0.72	100%	
Admission - Non Ventilated Neonate	14	33.93	8.29	100%	
Admission - Ventilated Neonate	15	53.93	11.27	100%	
Total	**139**				

STD = Standard Deviation

As shown in Table 5.5 the interventions in this category, with the exception of weight estimation for the ventilated neonate where an assistant was required for 30.77% of the total time, interventions were attended by the primary care nurse without any assistance. As indicated by the standard deviation (Std) shown in Table 5.5, the variability in the time taken to undertake some interventions was more significant than in others. Differences in the time taken for arterial blood gas collection and analysis (Std 1.09) was noted. During observation it was evident that this related to the functioning of the arterial line, some blood collections were attended with ease, while some required lengthy manipulation of the position and function of the line to enable sampling. Differences noted in the time taken for the admission process, both to Level 3 (Std 11.27) and Level 2

(Std 8.29) were larger than expected. Management of the environment at the time of admission, for example, organising oxygen administration and monitoring equipment, appeared to be a contributing factor to this significant variability. The time taken with accompanying parents was also variable.

5.2.4.3 Nutrition and Fluid Management

Presented in Table 5.6 are the results of 158 timings of twelve interventions related to nutrition and fluid management. Complete data shown in Appendix 10.

Table 5.6: Direct Care Observations: Nutrition and Fluid Management Activities

Nursing Intervention	N	Mean Total Time (Minutes)	STD	Primary Nurse Percent of Time	Assistant Nurse Percent of Time
Feeding - Bottle	16	27.56	7.85	100%	
Feeding - Gavage - Hourly	16	8.06	1.60	100%	
Feeding - Gavage - 2\24 or 3\24	17	16.00	3.46	100%	
Parenteral Fluid Line Change - Arterial	15	11.80	3.08	74.58%	25.42%
Parenteral Fluid Line Change - Central	16	39.19	8.13	62.20%	37.80%
Parenteral Fluid Line Change - Venous	14	16.43	1.12	74.78%	25.22%
Cannula Insertion Assist - Arterial	11	16.91	4.56	100%	
Cannula Insertion Assist - Venous	13	13.00	3.90	100%	
Cannula Removal	10	7.10	1.37	100%	
Catheter Insertion Assist - Central	10	32.10	8.10	100%	
Catheter Insertion assist - Umbilical	10	27.80	7.37	100%	
Catheter Removal	10	11.60	2.62	100%	
Total	**158**				

STD = Standard Deviation

As indicated in Table 5.6 an assistant nurse was required for interventions related to changing parenteral fluid infusions. With venous fluid line change (assistant for 25.22% of the intervention) and arterial fluid line change (assistant for 25.42% of time) the role of the assistant was to check the addition of medication or supplements to the parenteral fluids. Central line fluid changes were attended as a sterile procedure and an assistant was required (37.80% of time) to enable the primary care giving nurse to maintain sterility during changing the tubing and fluids. The standard deviation for interventions within this category indicated that variability in the time taken to undertake some activities was significant. Variability in the time taken for enteral feeding was related to the volume of the feed being given (hourly gavage feeding Std 1.60, and second or third hourly gavage feeding Std 3.46). In the case of bottle feeding (Std 7.85) the vigour with which the neonate sucked was also a contributing factor. During arterial line fluid changes, it was noted that arterial line infusion fluid was a stock solution which was constituted once daily and used for all neonates with arterial lines in situ. Variability in the time taken for changing the arterial line (Std 3.08) related to whether the nurses made up the stock solution at the time of changing the line or accessed the fluids already prepared. Differences in the length of time taken for central fluid line changes (Std 8.13) was related to the number of flasks of fluid needing to be changed. On one occasion one flask of fluid was changed, on the remaining fifteen occasions two flasks were changed. In those interventions where the nurse assisted the medical officer with cannula and catheter insertion, variability was dependent upon the ease and speed with which the medical officer achieved the procedure. Assisting with arterial cannulation (Std 4.56), venous

cannulation (Std 3.90), umbilical catheterisation (Std 7.37), and central venous catheterisation (Std 8.10) showed variability which was not unexpected. Cannulations and catheterisation were attended by registrars involved in a training scheme as well as trained neonatologists.

5.2.4.4 Hygiene, Comfort and General Care

Shown in Table 5.7 are the results of 178 timings of eleven nursing interventions relating to hygiene, comfort and general care activities. Complete data is shown in Appendix 11.

Table 5.7: Direct Care Observations: Hygiene, Comfort and General Care Activities

Nursing Intervention	N	Mean Total Time Minute	STD	Primary Nurse Percent of Time	Assistant Nurse Percent of Time
General Care - Ventilated Neonate	18	13.94	0.62	100%	
General Care - Non Ventilated Neonate	18	13.06	0.85	100%	
Bath	16	21.44	1.37	100%	
Sponge Bath	16	15.25	1.25	100%	
Physiotherapy - Chest	15	3.00	0.37	100%	
Endotracheal Tube Toilet	16	6.06	0.56	65.98%	34.02%
Nasopharyngeal Tube Toilet	15	3.53	0.50	100%	
Headbox Tubing Change	15	10.07	0.77	100%	
Ventilator Tubing Change	16	10.44	67.04	64.07%	35.93%
Comfort\Settling - Simple	17	7.76	0.88	100%	
Comfort\Settling - Involved	16	19.63	10.25	100%	
Total	**178**				

STD = Standard Deviation

As shown (see Table 5.7) an assistant nurse was required for endotracheal tube toilets and ventilator tubing change. During endotracheal tube toilets, an assistant was required for an average of 34.02% of the intervention to disconnect and reconnect the ventilator to the endotracheal tube during this procedure. While changing ventilator tubing the assistant hand ventilated the neonate for an average of 35.93% of the total activity while the primary nurse replaced the tubing.

The standard deviation for interventions within this category shows there was significant variability in the time taken to undertake some activities. The variability of time taken for comfort and settling activities was dependent, as expected, upon the neonate's response. A standard deviation of 5.05 was evident for these activities defined as simple comfort activities (see Appendix 8), and 10.25 minutes for those defined as involved comfort activities (see Appendix 8). The time taken for endotracheal tube toilets (Std 0.56) showed no significant variability. This was a surprising finding as the time taken for this procedure was dependent upon tolerance of the endotracheal suction and the need to allow a recovery phase during the suction.

5.2.4.5 Therapeutic and Diagnostic Interventions

Shown in Table 5.8 are the results of 107 timings of eight therapeutic and diagnostic activities. Complete data is shown in Appendix 12.

Table 5.8: Direct Care Observations: Therapeutic and Diagnostic Activities

Nursing Intervention	N	Mean Total Time Minutes	STD	Primary Nurse Percent of Time	Assistant Nurse Percent of Time
Medication Administration - Intravenous Bolus	16	13.38	1.41	70.35%	29.65%
Medication Administration - Intravenous Infusion	17	11.35	0.90	73.91%	26.09%
Medication Administration - Oral	16	2.44	0.50	75.32%	24.68%
Dressings	10	14.00	1.41	98.57%	1.43%
Extubation	15	20.50	1.18	79.44%	20.56%
Intubation - Assist	10	25.80	3.25	76.83%	32.17%
Ultrasound - Assist	10	10.10	1.92	100%	
X-Ray - Assist	13	8.23	1.76	100%	
Total	**107**				

STD = Standard Deviation

As illustrated in Table 5.8 an assistant was required for all activities except assisting with X-Ray and ultrasound. Administering medications required two nurses to check the drug order and calculation prior to administration. During intubation (assistant time 32.17% of total activity) an assistant was required to help both the medical officer intubating and the primary care giving nurse with endotracheal tube placement and fixation. During extubation (assistant time 20.56% of total) two nurses were required for the removal of the endotracheal tube, for positioning the infant and for stabilisation of ambient oxygen.

The standard deviation for interventions shown above in Table 5.8 indicated that the variability in the time taken to undertake some interventions was more significant than others. For administration of bolus intravenous medications a

standard deviation of 1.41 minutes is noted. During observation of these interventions, variability was related to the number of medications being administered and whether the medication was given as a single bolus or intermittently over a period of minutes. On four occasions one medication was administered as a single bolus. On twelve occasions two medications were administered slowly over a period of minutes while the nurses attended other activities at the bedside (for example, observations or general care activities).

Differences observed in the time taken when assisting the medical officer with intubation (Std 3.25) were noted. The time taken for this procedure was dependent upon the speed with which the medical officer was able to intubate, and required both the primary care giving nurse and an assistant for varying lengths of time until the endotracheal tube was positioned and secured. On two occasions the neonatologist attended the intubation, achieving this more quickly than on the other eight occasions observed where the registrar intubated. Variability in the time required for extubation (Std 1.18) was less than expected. During extubation varying lengths of time were required to settle the neonate after the endotracheal tube had been removed. It was not uncommon for the neonate to cry and be unsettled for a prolonged time after removal of adhesive strapping from the face.

5.2.4.6 Parent Education

Shown in Table 5.9 are the results of 50 timings of three activities relating to parent education. Complete data is shown in Appendix 13.

Table 5.9: Direct Care Observations: Parent Education

Nursing Intervention	N	Mean Total Time (Minutes)	STD	Primary Nurse Percent of Time	Assistant Nurse Percent of Time
Parental Education - Parentcraft	17	22.94	7.62	100%	
Parental Education - Assisting with Care	16	10.31	2.64	100%	
Discharge	17	57.00	8.15	100%	
Total	**50**				

STD = Standard Deviation

As shown in Table 5.9, there was variability in the time taken for those parental education sessions dealing with parentcraft activities (Std 7.62) and assisting with care activities (Std 2.64). Differences in the time required for education appeared to be related to the complexity of the education and whether this was a first episode of education or a follow-up reinforcement. Parentcraft education was noted on seven occasions to involve infant bathing, on six occasions feeding management and on the remaining four occasions the parents were being instructed in oxygen management. Assisting with care activities included various activities such as eye and oral toilets and general hygiene activities and the variability related to the same aspects as the parentcraft activities.

Variability in the time taken for discharge (Std 8.15) was greater than expected. A number of parentcraft demonstrations were reinforced at this time, and the comfort levels of the parents may be a contributing factor in the variability.

5.2.5 Summary

The results of activity sampling method of timing 632 attendances of forty three direct care nursing interventions has been presented.

The mean total time of each activity, together with the percentage of time attributable to the primary care giving nurse and any nurse assistant have been shown.

5.3 Indirect Nursing Care Activities

5.3.1 Introduction

In this section indirect nursing care activities observed and timed will be discussed. The total number of timings will be outlined and timings undertaken in intensive care (Level 3) and special care (Level 2) will be shown. Individual indirect care nursing activities will be discussed in the context of the total day observed, and in relation to the activities observed.

5.3.2 Total Indirect Care Nursing Activities

One hundred and eleven indirect care nursing activities were observed and timed. This was achieved by observing the activities of one individual nurse, during a complete eight hour shift, on twelve occasions (96 hours observation). Meal breaks were excluded from the observation time. Observations of indirect activities were attended in Hospital A and Hospital B.

Table 5.10: Indirect Care Observation: Eight Hour Shifts Observed in Hospital A and Hospital B

Hospital	Number of Eight Hour Shifts Recorded	Hours of Observation
Hospital A	9	72
Hospital B	3	24
TOTAL	**12**	**96**

As shown in Table 5.10 recordings of indirect activities were more in Hospital A than in Hospital B. Nine shifts were observed in Hospital A and three in Hospital B. Indirect nursing activities were observed in both intensive care (Level 3) and special care (Level 2) areas. Table 5.11 illustrates the number of eight hour shifts observed in both these areas.

Table 5.11: Indirect Care Observation: Eight Hour Shifts Observed in Intensive Care and Special Care Areas

Area	Number of Eight Hour Shifts Recorded	Hours of Observation
Intensive Care (Level 3	7	56
Special Care (Level 2)	5	40
TOTAL	**12**	**96**

As shown in Table 5.11, recordings of indirect activity were slightly more in Level 3 than in Level 2. Seven shifts (56 hours) of indirect care activity observation was undertaken in the intensive care area and 40 hours (5 shifts) in the special care area. A total of 96 hours (twelve eight hour shifts exclusive of meal breaks) observation was attended.

Observations were attended on both morning shift (0700 hours to 1530 hours), evening shift (1430 hours to 2300 hours) and night shift (2245 hours to 0715 hours) in both intensive care (Level 3) and special care (Level 2) areas. Table 5.12 illustrates the shifts observed in both of these areas.

Table 5.12: Indirect Care Observation: Eight Hour Shifts Observed on Morning, Evening and Night Shifts

Shift	Total	Level 3	Level 2
Morning Shift	7	4	3
Evening Shift	3	2	1
Night Shift	2	1	1
TOTAL	**12**	**7**	**5**

As illustrated (see Table 5.12) the predominance of indirect activity sampling occurred on morning shifts. A total of seven morning shifts were sampled four of these being undertaken in intensive care (Level 3) and three in Level 2 (special care). Evening shifts were sampled on three occasions, two in intensive care and

one in special care. Observation of activities on night duty was undertaken on two occasions, once in special care and once in intensive care.

Clinical Nurse Specialists (C.N.S.) and Registered Nurses (R.N.) were observed randomly according to their availability on the individual day. The same nurses (see Table 4.1) observed during direct care data collection were observed for indirect activity sampling. Table 5.13 illustrates the number of shifts where C.N.S. and R.N. were observed.

Table 5.13: Indirect Care Observation: Indirect Activities Observed by Nurse Status

Area	Total	C.N.S.	R.N.
Level 3	7	5	2
Level 2	5	1	4
TOTAL	**12**	**6**	**6**

As illustrated in Table 5.13, differences occurred in the status (C.N.S. or R.N.) of the nurses observed during indirect activity sampling. Six Clinical Nurse Specialists were observed, five of these in the intensive care area and one in the special care area. Six registered nurses were observed, two of these were in Level 3 and four in Level 2.

5.3.3 Individual Indirect Care Activities

The results of twelve days observation and timing of indirect activities will be presented. Table 5.14 shows the indirect activities observed and the number of occasions these activities were recorded over the twelve day sampling period. Descriptions of indirect activities are given in Appendix 14. Complete data regarding indirect activities by activity is shown in Appendix 15. Data by observed day is shown in Appendix 16.

Table 5.14: Indirect Care Observation: Individual Indirect Care Nursing Activities

Indirect Nursing Activity	Timings Recorded N.	Percent of Total Recordings *
Oncoming Nursing Rounds	12	11%
Reading Notes	12	11%
Checking Environment and Equipment	12	11%
Rounds with Medical Officer	10	8%
Replacing Equipment	7	6%
Discussions with Parents	25	23%
Documentation	12	11%
Preceptoring Staff	9	8%
Outgoing Nursing Rounds	12	11%
TOTAL	**111**	**100%**

* *Percentages rounded to nearest complete number.*

As illustrated in Table 5.14, the most frequent indirect activity observed over the twelve days sampled was discussions with parents, accounting for 23% of the total activities. There were indirect activities which occurred once each shift, namely nursing rounds, reading notes, checking the environment and equipment

and documentation. Other activities such as replacing equipment (N=7) occurred as a routine on morning shift. Participating in medical rounds did not occur on night duty as the registrar handover had taken place earlier in the evening.

5.3.4 Indirect Care Activities as Percentage of Each Observed Shift

Indirect activities observed over the twelve days sampled are shown in Table 5.15 in total minutes and as a percentage of that eight hour shift observed (% of 480 minutes). Complete data is shown in Appendix 16.

Table 5.15: Indirect Care Observation: Activities as Percentage of Each Observed Shift

Day Observed	Shift	Area	Total Minutes	Percent of Shift
1	Morning	Level 3	89	18.54%
2	Morning	Level 3	85	17.71%
3	Morning	Level 3	89	18.54%
4	Morning	Level 3	86	17.92%
5	Morning	Level 2	95	19.79%
6	Morning	Level 2	127	26.46%
7	Morning	Level 2	111	23.13%
8	Afternoon	Level 3	92	19.17%
9	Afternoon	Level 3	78	16.25%
10	Afternoon	Level 2	95	19.79%
11	Night	Level 3	64	13.33%
12	Night	Level 2	66	13.75%

It can be seen from Table 5.15 that indirect activities were more frequent on morning shift (range 18.54% to 26.46%) than on afternoon shift (range 16.25% to 19.79%). Night shift had the least recordings (range 13.33% to 13.75%).

Indirect care activities observed in Level 3 and Level 2 over the twelve days sampled are shown in Table 5.16. Activities are shown in total minutes and as a percentage of the eight hour shift (% of 480 minutes). Complete data is shown in Appendix 16.

Table 5.16: Indirect Care Observation: Activities in Level 3 and Level 2 Areas

Day Observed	Shift	Total Minutes	Percent of Shift
Level 3 (Intensive Care)			
1	Morning	89	18.54%
2	Morning	85	17.71%
3	Morning	89	18.54%
4	Morning	86	17.92%
8	Afternoon	92	19.17%
9	Afternoon	78	16.25%
11	Night	64	13.33%
Level 2 (Special Care)			
5	Morning	95	19.79%
6	Morning	127	26.46%
7	Morning	111	23.13%
10	Afternoon	95	19.79%
12	Night	66	13.75%

Table 5.16 illustrates that indirect care activities observed were generally greater in Level 2 (range 13.75% to 26.46%) than in Level 3 (range 13.33% to 19.17%).

One aspect of indirect care which was significant to the increased percentage of time of indirect activities in Level 2 was the discussions the nurses had with the parents. Discussions with the parents of each neonate occurred frequently throughout each shift. Twenty five observed discussions took place over the twelve days sampled. Some discussions were face to face and some involved telephone conversations. An average time of 8.46 minutes (Std 4.94) or 1.78% of the shift was spent on each nurse\parent interaction. This varied according to the individual day, the area (intensive care or special care) and the number of parents the nurse dealt with. Table 5.17 illustrates the area, number of families involved and the amount of time spent on discussions with parents on each observed day. Complete data is shown in Appendix 15.

Table 5.17: Indirect Care Observation: Discussions with Parents

Day	Shift	Number of Families	Number of Discussions	Total Minutes	Percent of Shift
Level 3					
1	Morning	1	3	20	4.16%
2	Morning	1	1	19	3.95%
3	Morning	1	2	21	4.37%
4	Morning	1	2	18	3.75%
8	Afternoon	1	1	5	1.04%
9	Afternoon	1	1	10	2.08%
11	Night	1	1	5	1.94%
Level 2					
5	Morning	1	1	15	3.12%
6	Morning	3	3	28	5.83%
7	Afternoon	3	3	20	4.16%
10	Afternoon	2	2	10	2.08%
12	Night	3	3	10	2.08%

As it can be seen from Table 5.17, discussions with parents generally involved more time per shift in Level 2 (range 2.08% to 5.83%) than in Level 3 (range 1.04% to 4.37%).

Indirect activities observed over the twelve days sampled varied both in minutes and percentage of time according to the shift observed. Table 5.18 illustrates the results of twelve days observation. Firstly data is shown as the average time taken for each activity over the twelve days sampled, together with the standard deviation and the average time per shift for each activity. Data is then broken down to reflect the three shifts sampled (morning, afternoon and night). The average time for each activity per shift is shown and displayed as a percentage of that shift. The average percentage of indirect care per day is shown, together with the average percentage of indirect care per shift. See Appendix 16 for complete data per day observed.

Table 5.18: Indirect Care Observation: Indirect Activities Per Average Day and Average Shift

Indirect Activity	Average Time Per Attendance of Activity Over 12 Days Sampled	Std	Average Percent of Shift Per Attendance Over 12 Days Sampled	Average Time Per Shift (Minutes) Over 12 Days Sampled			Average Percent of Shift Over 12 Days Sampled		
				Morning 7 Shifts	Afternoon 3 Shifts	Night 2 Shifts	Morning 7 Shifts	Afternoon 3 Shifts	Night 2 Shifts
Oncoming Nursing Round	30.83	1.95	6.42%	29.86	32.67	31.50	6.22%	6.81%	6.56%
Reading Notes	8.67	3.40	1.81%	9.57	7.33	7.50	1.99%	1.53%	1.56%
Check Environment\Equipment	3.83	1.34	0.80%	4.43	3.33	2.50	0.92%	0.69%	0.52%
Rounds with Medical Officer	7.60	2.73	1.32%	8.00	6.67	0.00	1.67%	1.39%	0.00%
Replacing Equipment	4.29	1.98	0.52%	4.29	0.00	0.00	0.89%	0.00%	0.00%
Discussions with Parents	8.56	4.94	3.72%	22.00	15.00	7.50	4.58%	3.13%	1.56%
Documentation in Notes	10.92	3.48	2.27%	12.00	10.67	7.50	2.50%	2.22%	1.56%
Preceptoring	7.33	2.67	1.15%	4.14	9.33	4.50	0.86%	1.94%	0.94%
Outgoing Nursing Round	3.33	1.43	0.69%	3.14	3.33	4.00	0.65%	0.69%	0.83%
TOTAL				**97.43**	**89.33**	**65.00**			
AVERAGE PERCENT OF SHIFT	**17.41%**			**20.30%**	**18.40%**	**13.54%**			

It can be seen from Table 5.18 that the average percent of the nurse's shift for indirect activities over the 12 days sampled was 17.41%. On a morning shift the average was highest at 20.30% of the shift. Night nurses had the lowest average at 13.54% of the shift while on afternoon shift the indirect activities were an average of 18.40% of the nurse's shift.

5.3.5 Resident Neonatal Population and Rostered Nurses Present During Indirect Activity Sampling

The resident client population and nurses rostered to the neonatal units varied during the observation period. Table 5.19 illustrates the client population and the number of nurses rostered to the area on the twelve days sampled.

Table 5.19: Resident Neonatal Client Population and Nurses Rostered to the Area During Indirect Activity Sampling

Day Observed	Shift	Resident Neonatal Client Population	Rostered Nurses
		N.	N.
1	Morning	29	12
2	Morning	26	11
3	Morning	30	12
4	Morning	27	12
5	Morning	28	12
6	Morning	29	12
7	Morning	32	13
8	Afternoon	32	12
9	Afternoon	30	12
10	Afternoon	29	12
11	Night	28	12
12	Night	29	12
	Average	**29.08**	**12**

Table 5.19 illustrates that the client population was variable during the indirect activity sampling period. The average client population over the 12 day period was 29.08 neonates. The average nurse population during the sampling period was 12 nurses which was consistent with normal rostering patterns in both units.

5.3.6 Summary

The results of twelve days observation of indirect care nursing activities has been presented. It has been shown that the average percentage of indirect care for a morning shift was 20.30% of the nurse's time, for afternoon shift 18.40% and for night shift 13.54%. The overall average percentage of the nurse's time spent on indirect activities was 17.41%. The average neonatal client census was 29.08 and the average number of nurses rostered to the area on each shift was twelve.

5.4 Expert Nurses' Judgement

5.4.1 Introduction

In this section the results of data collected relating to the time required for thirty three commonly occurring nursing interventions given by sixteen expert nurses is shown. Nurses were asked their judgement only in relation to nursing interventions, activities which involve a medical practitioner or allied health practitioner were not included as the time taken for these activities is based on the expertise of another person and is outside the control of the nurse. Nurses were asked to consider that the time involved included preparation and attending the intervention, any nurse assistant required during the activity, disposal of used

equipment and documentation at the completion of the activity, together with settling activities involved.

All sixteen Clinical Nurse Specialists participating in this part of the study were taken from the nineteen consenting C.N.S. from Hospital A (See Table 4.1). The three C.N.S. from Hospital A who were not involved in the expert nurse judgement were on maternity leave during this part of the research and were not approached.

5.4.2 Expert Nurses' Assessment of Time Required for Nursing Interventions

The data collected from expert nurses showing their judgement of time taken for thirty three commonly occurring nursing interventions is shown in Table 5.20. The results of the expert nurses' judgement shows the number of nurse assessments, the mean of the assessed time, the standard deviation (Std) and the coefficient of variation. The complete data is illustrated in Appendix 17. The comparison between observer timed direct care interventions and the nurses' assessment is shown in Appendix 18.

Table 5.20: Expert Nurses' Assessment

Intervention	N	Mean Total Time	STD	Coefficient of Variation
Observations - Non ventilated neonate	16	2.63	0.48	34.51%
Observations - Ventilated neonate	16	4.81	0.88	20.00%
Blood Gas - Arterial	16	7.19	0.73	10.10%
Blood Gas - Peripheral	16	8.13	0.33	6.56%
Blood Glucose Monitoring	16	4.25	0.43	10.19%
Weight Estimation - Non ventilated neonate	16	8.63	0.93	11.33%
Weight Estimation - Ventilated neonate	16	11.25	1.95	11.74%
Admission - Level 2	16	32.19	2.48	7.71%
Admission - Level 3	16	56.88	3.00	5.27%
Feeding - Bottle	16	28.75	2.17	7.53%
Feeding - Gavage - Hourly	16	8.50	0.61	7.20%
Feeding - Gavage - 2\24 or 3\24	16	16.88	2.42	14.34%
Fluid Line Change - Arterial	16	10.81	1.38	12.76%
Fluid Line Change - Central	16	39.06	3.17	8.12%
Fluid Line Change - Venous	16	15.63	1.65	10.58%
General Care - Non ventilated Neonate	16	15.31	1.21	6.88%
General Care - Ventilated Neonate	16	17.81	2.48	9.89%
Bath	16	25.94	1.95	10.87%
Sponge Bath	16	17.81	2.48	12.25%
Physiotherapy - Chest	16	3.06	0.24	7.90%
Comfort\Settling - Involved	16	17.91	2.48	14.43%
Comfort\Settling - Simple	16	9.38	1.65	21.37%
Endotracheal Tube Toilet	16	5.31	0.46	9.06%
Nasopharyngeal Toilet	16	3.44	0.50	14.43%
Headbox Tubing Change	16	8.75	0.97	11.07%
Ventilator Tubing Change	16	10.63	1.65	15.56%
Medications - Intravenous Bolus	16	11.88	2.42	11.16%
Medications - Intravenous Infusion	16	15.31	1.21	8.25%
Medications - Oral	16	4.38	0.93	18.44%
Extubation	16	21.56	2.32	10.75
Education - Parentcraft	16	24.06	2.63	10.94%
Education - Assist with Care	16	11.88	2.42	20.38%
Discharge	16	57.19	2.48	4.34%

As illustrated in Table 5.20, the standard deviation of the nurses' judgement showed some variability. The greatest difference noted was for admission to Level 3 (Std 3.00) while the smallest difference was noted for chest physiotherapy (Std 0.24) Of the total thirty three judgements, 36% indicated a standard deviation of less than one minute, 24% showed a standard deviation between one and 1.99 minutes, 34% indicated a standard deviation of two to 2.99 minutes and the remaining 6% showed a standard deviation greater than three minutes.

To determine reliability of the expert nurse assessments the Kendall Coefficient of Concordance was applied, W = 0.972 (see Appendix 19) demonstrating reliability of the data.

5.4.3 Summary

The judgement of sixteen expert nurses related to the time taken for thirty three direct care interventions has been presented. The intra-rater reliability has been demonstrated by use of the Kendall Coefficient of Concordance.

5.5 Summary

Results of observation and timing of direct and indirect care activities have been shown. The results of expert nurses' judgement of time required for direct care interventions has also been shown. The results presented in this chapter are discussed in Chapter 6.

CHAPTER SIX

DISCUSSION

CHAPTER 6: DISCUSSION

6.1 Introduction

This study has focussed on the development of a nursing intensity system for neonatal care. Direct and indirect nursing activities were examined and average times required for these activities were determined. This data allows the development of a tool which could be used for staff scheduling. Expert judgements from neonatal nurses regarding the time required for nursing interventions were also obtained. This was attended to validate the timings obtained through activity sampling method.

In this chapter the results of observation and timing of nurse's care giving activities in the neonatal unit, together with the expert nurses judgement will be discussed. The format observed for this chapter is similar to that adopted for Chapter 5. Discussion involving findings will be presented in relation to the aims and objectives as stated in Chapter 1, Section 1.4. The development of the Neonatal Nursing Intensity System is shown in Chapter 7.

6.2 Direct Nursing Care Activities

6.2.1 Introduction

Nursing practice within the neonatal units was governed by unit philosophy and policy. Criteria were set down for attendance\non attendance of nursing interventions and guidelines were present for accepted safe practice of direct care

nursing interventions. In some instances safe practice was defined as the presence of two registered nurses for some nursing interventions.

Some direct nursing care interventions observed in the neonatal units were attended on a routine basis for monitoring purposes or as part of general nursing care. These interventions were attended either hourly, second hourly, third hourly, or in some cases fourth hourly intervals based on need, nursing assessment and\or unit policy. A second group of direct care activities were attended on a frequency basis which was determined by the assessed needs of the individual neonate rather than on the clock, and in some cases had no regular pattern of attendance. Another group of direct care activities were attended on a daily, second daily or even third daily basis on no particular shift, depending on the routine of the neonatal unit, while still other direct care activities occurred randomly and their occurrence could not be predicted. Most interventions were attended solely by the primary care giving nurse, however there was a proportion of interventions which required the assistance of a second nurse as dictated by unit policy.

The nursing resources required in the neonatal unit are dependent upon the interventions attended for each neonate and the frequency with which interventions are attended. The neonate will have varying interventions attended on any given shift on any given day. The results of observation and timing of nursing interventions presented in Chapter 5 provide baseline data regarding time required to attend nursing interventions for one occasion. The baseline data

presented in Chapter 5 accepts the arithmetic mean of multiple attendances of interventions as average practice. Williams in 1983 put forward the view that standard times should be increased by 20% to allow for fatigue and individual variance. In this study the arithmetic mean of all timed interventions attended by a wide range of nurses with varying experience and expertise has been accepted as more reflective of real practice. The data presented can be built upon to provide retrospective documentation of utilisation of nursing time and to predict future resource needs. Imperative for this monitoring of expenditure of nursing hours is the facility to document individual interventions, and the frequency of attendance of these interventions, for each baby in the neonatal unit. The development of the Neonatal Nursing Intensity System with consideration of these variables is shown in Chapter 7. Direct nursing care interventions will be discussed in the same categories as outlined in Chapter 5. A description of the nursing activities involved is given in Appendix 8.

6.2.2 Observation and Monitoring

Some observation and monitoring activities (for example, observation of vital signs) were attended on a regular basis throughout the shift and ranged in frequency from hourly to fourth hourly. The frequency these interventions were attended, was based on unit policy and a needs assessment by the nurse involved. Other monitoring activities were attended regularly, although not necessarily on a regular hourly routine, and varied in their attendance from one to two or three times per shift. This group of interventions included blood gas analysis and blood glucose monitoring and were attended according to unit policy, medical request or

needs assessment. Weight estimation was attended on a regular basis, although this may be daily, second daily or third daily, based on management need or unit policy. Weight estimation for the ventilated neonate was the only intervention which required the assistance of a second registered nurse. Admission to the neonatal unit was generally unpredictable and often occurred at short notice.

Results of observational studies presented in Chapter 5, (see Table 5.5), illustrate the time taken for observation and monitoring activities for a single occurrence of each intervention. Determination of the nursing resources required to attend these activities for an eight hour shift or a 24 hour period is dependent upon the intervention attended and the frequency of attendance. It can be seen from Table 5.5 that observation and documentation of vital signs for a ventilated neonate required an average of 2.50 minutes per single attendance. Continuous electronic monitoring provided close observation, however documentation of these observations occurred hourly. This activity equated to twenty minutes per shift or 60 minutes of nursing time per day. Observation of the non ventilated infant's current status assessed fewer parameters than the ventilated neonate and required 1.75 minutes per attendance. Continuous electronic monitoring was also utilised in the care of the non ventilated neonate, and documentation of these observations was attended on a frequency ranging from hourly to fourth hourly, depending on the individual neonate's condition. Where hourly observations were required, this equated to usage of forty two minutes per 24 hours, however if attended fourth hourly, 10.5 minutes of nursing time per day were required.

Nursing activities such as blood gas analysis and blood sugar monitoring may or may not be attended, depending on the individual infant's condition. As shown in Table 5.5, arterial blood gas analysis required 6.94 minutes per attendance. The ventilated neonate required attendance of arterial blood gas analysis on a regular basis depending on assessment of clinical indicators, or after changes to ventilation support. Where required hourly, for a very ill neonate, 56 minutes of nursing time per shift was required. On those occasions where one blood gas analysis per day was required for progress monitoring this was generally attended by peripheral blood gas sample, and required 7.25 minutes of nursing time. Blood glucose monitoring was generally attended fourth hourly or sixth hourly, but may be attended more frequently if the blood glucose was unstable. Where fourth hourly assessments were required, eight minutes of time was used per shift, second hourly assessment resulted in usage of 16 minutes per shift.

It can be seen that nursing time required for observation and monitoring activities will vary greatly, being based on unit policy, the nurse's assessment of frequency required, or on the order of the medical officer. To capture meaningful estimations of nursing resources required, it is necessary to consider which activities will be attended, together with the frequency these are attended. Different neonates will require differing nursing hours per day, dependent on care required.

6.2.3 Nutrition and Fluid Management

During observation of activities related to nutrition and fluid management it was observed that gavage feeding was generally the only intervention which was

attended at frequency intervals based on hours. Gavage feeding was usually attended hourly, second hourly or third hourly depending on the neonate's weight, the volume of the feed and the tolerance to enteral feeding. Bottle feeding was generally offered to convalescent babies who were demand fed, and therefore fed at irregular intervals. Data presented in Chapter 5 (see Table 5.6), shows the time taken for each activity related to nutrition and fluid management per single attendance. It can be seen that hourly gavage feeding required 8.06 minutes per feed to procure the milk, check the position of the gastric tube and attend the feed by gravity flow. This equated to usage of sixty four minutes of nursing time per eight hour shift. Third hourly gavage feeding required 16.00 minutes per feed for the same activity, the difference in time required being directly related to the volume of the feed. Third hourly feedings resulted in usage of forty three minutes of nursing time per eight hour shift. The time required for bottle feeding depended on the needs and demand of the neonate. As shown in Table 5.6, one bottle feeding, which included obtaining the milk, feeding, "winding" and settling after the bottle, required 27.56 minutes of nursing time. Two bottle feeds per shift would equate to 55 minutes per shift, or if three bottles were demanded, 83 minutes of nursing time would be required.

Parenteral fluid lines were routinely changed each twenty four hours, however on some occasions this occurred more frequently where the neonate was extremely low birth weight or very ill, and there existed a need to change the constituents of the fluids. Four methods of administration of parenteral fluids were used, namely venous, arterial, umbilical and central venous, and these fluids were routinely

changed on different shifts according to unit policy in an attempt to evenly distribute the workload. Parenteral fluid management has an impact on the nursing hours required for each neonate as can bee seen from Table 5.6. The need to change arterial infusion fluids and lines resulted in usage of 11.80 minutes of nursing time, while changing venous infusion fluids required 16.43 minutes. Within each of these activities was the need to add medications or supplements, connect and prime the infusion set and prepare the infusion pump. Both of these activities required a second registered nurse for 25% of the time involved because of unit policy. Central venous fluid management required an average of 39.19 minutes to change the fluids and lines as a sterile procedure. The assistance of another registered nurse was required for 37.80% of the total time for this procedure. For a neonate with all three forms of parenteral fluid therapy, which was not uncommon in neonatal intensive care areas, 67.43 minutes of care each 24 hours was required merely to change the parenteral infusion fluids and lines. The need to insert\resite any arterial or venous cannula or catheters for fluid management is also consuming of nursing time. Venous\arterial cannulation or catheterisation occurred randomly based on need to commence or maintain parenteral fluids. On some occasions it was observed that a neonate may require cannulation more than once within 24 hours, or more than once per shift, or not at all, this being directly related to the friability of the neonatal veins. Catheterisation generally occurred less frequently than cannulation, although central venous catheterisation and umbilical catheterisation may both be attended on one shift where the neonate was sick or newly admitted to the unit. Assisting with insertion of an arterial cannula required 16.91 minutes (see Table 5.6), a

venous cannula 13.00 minutes and a central venous or umbilical catheter around half an hour each. Successful cannulation or catheterisation was dependent upon the expertise of the person cannulating and did not always occur at first attempt. On occasions the nursing time may be doubled as the medical officer took a break and then returned to attempt the entire procedure again. Cannulation and catheterisation was attended by registrars and neonatologists, and the experience level of the individual involved may account for some of the variability in the time taken. Removal of cannula and catheters were generally attended during other activities, such as general nursing care. For this reason, and for the spasmodic nature of the procedure and the small amount of time involved (2.70 minutes for cannula removal and 5.80 minutes for catheter removal) these have been given no further consideration.

It can be seen that many variables exist in relation to nutrition and fluid management when attempting to capture accurate information regarding nursing resources required. The neonate's tolerance to gavage feeding and the need to either increase or decrease frequency of feeding impacts on nursing time, as does the neonate's demand for bottle feeding. Some aspects related to nutrition and fluid management are outside the nurses control, such as time required to assist with cannulation and the medical officer's choice of fluid management method, whether venous or central venous. A noticeable difference in nursing time was required from the nurses when managing these modes of parenteral fluid therapy.

6.2.4 Hygiene, Comfort and General Care

Observation of interventions relating to hygiene, comfort and general care activities yielded the same information regarding attendance as those observed in the previous two categories. Hygiene, comfort and general care activities which were attended on an hourly frequency were general care activities, endotracheal and nasopharyngeal tube toilets and chest physiotherapy. Bathing and sponge bathing was attended on any shift, generally daily or second daily depending on the condition of the neonate. It was not uncommon for a neonate to require more than one bath per day for hygiene needs. Environmental hygiene activities such as changing headbox tubing or ventilator tubing were attended according to unit policy, normally three times per week and while generally attended on morning shift, may occur on any shift depending on workload at the time.

Results of observational studies presented in Chapter 5 (see Table 5.7) show the time taken for each intervention within this category per single attendance. It can be seen that general care activities, which included eye and oral hygiene, nappy change, repositioning and resiting of electronic monitoring devices, for the non ventilated infant required 13.06 minutes per single attendance. General nursing care activities were attended third or fourth hourly, depending on frequency of feeding, in an effort to minimise the disturbance to the neonate and promote rest and sleep. Where general nursing care was attended third hourly, 35 minutes of nursing time would be required per shift and a total of 104 minutes per twenty four hour period. General care activities for the ventilated infant were commonly attended fourth hourly to minimise disturbance and handling.

Requiring 13.94 minutes per attendance, this activity utilised twenty eight minutes per eight hour shift and 84 minutes per day when attended fourth hourly.

Endotracheal tube toilets required two nurses, as dictated by unit policy, for 34.02% of the 6.06 minutes per attendance (see Table 5.7). Endotracheal tube toilets were generally attended hourly or second hourly, depending on the need to clear pulmonary secretions and stability of the neonate. For some extremely ill neonates who tolerated this procedure poorly, attendance was third or fourth hourly. Forty eight minutes of nursing time per shift were required when attended hourly or twenty four minutes per shift when attended second hourly. Nasopharyngeal tube toilets were also seen to be nursing time consuming (see Table 5.7) requiring 3.53 minutes of one nurse's time per toilet. Generally attended hourly due to the position of the tube and the secretions generated by the presence of the tube, this resulted in usage of 28 minutes of nursing time. Chest physiotherapy was attended at regular intervals, generally second or fourth hourly in preparation for endotracheal tube toilets. Where pulmonary secretions were copious, more frequent physiotherapy was attended. As 3.00 minutes were required per physiotherapy session for postural drainage and percussion, 36 minutes of nursing time per twenty four hours were required if attended second hourly, or eighteen minutes per day where attended fourth hourly. Bathing and sponge bathing were shown to be time consuming of nursing time (bath 21.44 minutes and sponge 15.25 minutes) and were attended on any shift, although not necessarily every day. Environmental hygiene activities of headbox and ventilator tubing changes required around ten minutes of nursing time, and were attended on any shift according to the policy of that particular unit and to the workload.

Psychosocial aspects of care such as comfort and settling activities for the baby and discussions with, or education sessions for, the parents were one aspect of nursing activities which were observed to be both erratic and time consuming. Many authors have pointed out the need for the inclusion of a psychosocial component of care when assessing nursing resource needs (Abdellah and Levine, 1979; Giovanetti, 1979; Cuthbert,1983). The neonate is unique in that (s)he is pre-vocal and therefore the normal psychosocial component of care cannot be measured in the same way. Psychosocial activities within the neonatal unit are two-fold: those which involved the parents and those which involved the baby. Psychosocial components of care related to the individual neonate were observed as ongoing activities throughout the nurses' day. Settling activities necessary as part of the intervention itself, for example after feeding, general care or painful procedures were included in the timing for that intervention. Activities which related only to settling and comfort for the distressed or agitated baby and occurred as an activity not related to any other intervention have been considered as a separate direct care activity. Some neonates, those who were extremely ill and unstable, received no activities of this type, these infants were often treated with medication designed to maintain muscle relaxation, and handling was minimised because of the infant's instability. There were other neonates who required a great deal of comforting several times a shift, and on each shift. Some babies who were distressed required stroking, gentle speech and soothing, and settled after an average observed period of 7.76 minutes. These activities have been termed simple comfort\settling activities. Other babies required more involved activities such as cuddling, relaxation massages or in some instances

relaxation bathing to settle and soothe them, for an average observed time of 19.63 minutes. The time spent comforting the babies was extremely varied (standard deviation 10.25 minutes for the involved comfort\settling activities), and with some babies was a very time consuming but necessary part of care giving within the neonatal unit.

The amount of time involved in psychosocial activities with the parents has been considered in two ways. Parent education was considered a direct care activity because it generally involved the baby, and discussions with parents have been considered an indirect activity because generally no patient contact was involved.

It can be seen that in relation to hygiene, comfort and general care activities, the attendance and frequency which interventions were attended was a major consideration in nursing hours required to provide care. With activities within this category, usage of time is dependent mainly on the nurse's judgement of the individual neonate's need.

6.2.5 Therapeutic and Diagnostic Interventions

Interventions relating to therapeutic and diagnostic activities were not generally attended on a frequency determined by hours. Administration of medications were attended regularly, however these were based on prescription by the medical officer and there were no set times for these activities. Bolus intravenous medications were generally administered twice daily and occurred on any shift. Intravenous infusion medications were commenced either twelve or 24 hourly

depending on the prescription. Intubation was attended on a needs basis for respiratory support, and assisting with X-Rays or ultrasound were attended as the result of an order by the medical officer. These occurred on any shift and on more than one occasion per shift.

Results of observation studies presented in Chapter 5, see Table 5.8, show the time required to attend these individual therapeutic and diagnostic activities per single attendance. Intravenous bolus medications observed required two nurses for 29.65% of the average 13.38 minutes per administration. Two medications were administered on 75% of occasions observed. The most frequent group of medications administered were antibiotics and most babies were ordered two antibiotics, both given at the same time. Commencing intravenous infusion medications required two nurses for 26.09% of the average total time of 11.35 minutes. Intravenous infusion medications ordered were generally for pain relief, muscle relaxation therapy or for specific antibiotics where slow infusion was desirable.

Intubation was shown to be time consuming of nursing hours (see Table 5.8) with 25.80 minutes required per intubation. Two nurses were required for 32.17% of time for positioning the infant and stabilisation of the endotracheal tube. X-rays (8.23 minutes) and ultrasound (10.10 minutes) were less labour intensive for the nurses. X-Rays were attended on a daily basis, sometimes more frequently, for ventilated infants while ultrasound was attended for diagnostic and management requirements. Where both procedures were attended on one shift, eighteen

minutes of nursing time were utilised assisting with these procedures and reorganising the infant afterwards. Wound dressings, where required, were generally attended once per shift, although on occasions more frequently. The most common dressing observed were stoma dressings, one attendance required 14.00 minutes of time.

It can be seen that the nursing hours required to attend interventions relating to diagnostic and therapeutic activities depends on the need for the intervention and the frequency of attendance. The facility to document participation in these activities and the subsequent usage of nursing time must be included in a tool to measure nursing resource utilisation.

6.2.6 Parent Education

Education of parents was observed to be attended when the parents were present and were ready for education either in parentcraft skills or in activities to assist with care. These activities occurred randomly on any shift, sometimes on each shift, and as can be seen from results of observational studies presented in Chapter 5 Table 5.9, required a considerable commitment of nursing time. Parentcraft education such as bathing, oxygen management or feeding, was generally a more involved session and required an average of 22.94 minutes per session, while education to assist with care, such as nappy change, eye and oral hygiene, was more simple and required 10.31 minutes of nursing time. The time taken for education was varied, the standard deviation being 6.35 minutes for parentcraft activities and 2.64 minutes for assisting with care activities. This was

not an unexpected finding and was related to whether this was a first or follow up education session. Discharge from the neonatal unit was also shown to be a lengthy process (see Table 5.9) requiring an average of 57 minutes for completion. Education of parents was observed to be a major component of the nurses' activities within the neonatal unit and must be acknowledged for the nursing time involved. The importance of recognising nursing hours spent on patient\family education when assessing nursing resource needs was pointed out by Cuthbert (1983:22-24).

6.2.7 Summary

The results of observation and timing of direct care nursing activities has been discussed. It has been shown that there are many variables to consider when developing a tool to measure and predict nursing resources required in a neonatal unit. These variables include unit policy, the severity of illness and the need for intervention, and physician request. It has been shown that nursing activities within the neonatal unit are generally intervention orientated and tailored specifically to the individual's need. This has resulted in the decision to develop a factor evaluation nursing intensity system which has the flexibility to consider interventions attended and to consider the frequency of attendance of each intervention as a measure of intensity of need for nursing care. To develop a prototype patient classification system would result in several categories and lead to possible ambiguity. A prototype system would not provide the flexibility and accuracy offered by a factorial tool and may be less acceptable to nursing administrators and clinical nurses. As previously discussed, nursing practice was

governed by unit philosophy and policy. Were this policy to change significantly, the time taken to attend nursing interventions would also change and the patient classification system would require modification to reflect altered practice. Neonatal nursing, like other forms of critical care nursing, is dynamic and nursing practice is being changed or refined continually. Flexibility is therefore necessary to potentially alter the time for one or several nursing interventions or to include new practices within the total. This consideration supports the decision to devise a factorial patient classification system. Williams in 1983 put forward the view that standard times for nursing activities should be increased by 20% to allow for fatigue and individual variance. In this study this has not been given consideration. Rather, all timings of interventions have been included, having been attended by nurses with a wide range of experience and expertise. The arithmetic mean of multiple attendances has been accepted for development of the patient classification system as it was felt by the researcher that this is more reflective of the real situation in the neonatal unit. The development of the Neonatal Nursing Intensity System is shown in Chapter 7.

6.3 Indirect Nursing Care Activities

6.3.1 Introduction

As previously indicated in Section 6.2, nursing practice within the neonatal units sampled was governed by unit philosophy and policy. Criteria for indirect nursing activities to ensure a safe environment were included in this policy. Both of the neonatal units sampled had supernumary Nursing Unit Managers who focussed on administrative activities. Both units had nursing assistants who were

responsible for restocking patient care areas and for non patient orientated cleaning. The focus of indirect care activity observation was clinical nursing. As the administrative structure of each unit was dependent upon unit policy no attempt to quantify administrative activities has been attended.

Indirect nursing activities observed in the neonatal unit over a twelve day observation period generally fell into a pattern which included environmental safety monitoring and maintenance, documentation and information sharing activities. Some indirect nursing activities were attended each shift, some occurred each day and others were attended randomly when necessary.

The results of timing of indirect nursing activities presented in Chapter 5 provide information which can be used to calculate an average percentage of time for each shift. This can be included when monitoring and predicting nursing resources necessary in the neonatal unit to account for activities which do not directly involve the neonate, but are necessary for complete care.

6.3.2 Individual Indirect Nursing Activities

As previously stated, the indirect nursing care activities attended by the nurses observed fell into discrete groups. Activities which could be considered information sharing included oncoming and outgoing nursing rounds, individual handover, medical rounds, preceptoring other staff, and discussions with parents. Oncoming nursing rounds consisted of a nursing handover round of all patients together with allocation of staff. This was attended as the first activity of the

shift. This activity required an average time of 30.83 minutes or 6.42% of the shift (see Table 5.18). The first activity after oncoming rounds was a detailed individual handover with the nurse caring for each individual neonate on the previous shift. This was attended using the notes and observation charts for each neonate. As shown in Table 5.18, this required an average time of 8.67 minutes or 1.81% of the shift. Outgoing nursing rounds, as shown in Table 5.18, required an average of 3.33 minutes or 0.69% of the observed nurse's time. This occurred at the end of the shift and was each individual's contribution to the oncoming round for the next shift. The length of time taken for these activities was dependent upon the illness of the neonate and the amount of information necessary to be discussed.

Medical rounds with the neonatologists and registrars occurred twice daily, once on morning shift and again on evening shift. On average, as shown in Table 5.18, this required 7.60 minutes or 1.32% of the nurse's shift. The nurses took part in these rounds in relation to the neonates they were caring for, discussing progress and planning care for the next twelve hours. Consistent with nursing rounds, medical round times varied according to the severity of illness of the individual neonate. Preceptoring other staff was an activity which occurred randomly according to need. As illustrated in Table 5.18, this required an average time of 7.33 minutes or 1.15% of the shift for each attendance. It can be seen that preceptoring occurred more frequently on afternoon shift and night shift than on morning duty. This is not an unexpected finding as clinical educators in

neonatal units sampled worked morning shift and after those hours the Clinical Nurse Specialists or senior registered nurses had more of an education role.

Discussions with parents was one indirect care activity which was time consuming for nurses. As can be seen from Table 5.14, twenty five discussions with parents were observed over the twelve day observation period. These included face to face discussions as well as telephone conversations. As illustrated in Table 5.18, these were unevenly distributed over the three shifts. On morning shift an average of 22 minutes or 4.58% of time available was spent in discussions with parents. It was during the morning shift when the mothers generally came and spent several hours, wanting to discuss their baby's progress. Often there was a phone call from the father during the morning shift as well. Evening shift was the time when both parents and other siblings would come to visit, and an average of fifteen minutes or 3.13% of the shift would be spent in discussions at this time. Night duty was generally the shift with the least parent contact, although there was normally a phone call when the parents awoke to discuss progress overnight and it was not uncommon for the parents to ring during the night if they woke or could not sleep because of anxiety about their baby's condition. This resulted in an average time on night duty for discussions with parents of 7.5 minutes or 1.56% of the available shift.

Environmental safety monitoring activities were attended by each nurse when taking over care for that shift. Equipment used in care of the neonates, such as monitors, ventilators, suction and resuscitation equipment was checked for

function, and preparedness for use. As shown in Table 5.18, this activity required an average of 3.83 minutes of nursing time or 0.80% of the shift each attendance. Documentation relating to each neonate were attended by nurses at the end of their shift. On average 10.92 minutes or 2.27% of available time was spent in this activity. Routine replacement of equipment such as suction bottles was attended on the morning shift. This required an average time of 4.29 minutes or 0.52% of the shift.

6.3.3 Indirect Nursing Activities as a Percentage of Each Nurse's Shift

Differences were observed in the amount of indirect activities attended by the nurses observed per shift. Table 5.18 illustrates that indirect care activities averaged over the day comprised 17.41% of the nurse's shift. This was further broken down to show that on morning shift, indirect activities comprised 20.30% of the shift, on afternoon shift 18.40%, and on night shift 13.54%. It can be seen from Table 5.16 that indirect care activities undertaken were greater in Level 2 than in Level 3. Shown in Table 5.17, this related directly to the increased time spent on discussions with parents. In Level 2 areas, the nurse may have cared for three or four babies and generally had discussions with parents of each baby. In Level 3, the nurse often had only one baby to care for.

6.3.4 Allocation of Time for Indirect Nursing Activities

Methods of allocation of time for indirect activities in the literature are inconsistent, as are the definitions of indirect care activities. The indirect activities observed and recorded in this study were patient orientated and the amount of time necessary for these activities was directly related to the number of babies in the neonatal unit. If the neonatal population was not present, there was be no need to attend information sharing activities, environmental safety monitoring or to discuss progress with the parents. Vanputee, Sovie, Tarcinale and Stunden (1985) classified similar activities and called these patient assignable other time or unit constant time and allocated this time equally to the client population regardless of the acuity. This method has logic and value, and has been adopted for the equitable allocation of indirect care time for the Neonatal Nursing Intensity System.

During the indirect activity sampling period the average client population (see Table 5.19) was 29.08. On average there were twelve nurses rostered for clinical care during this period of time. There was no difference between the number of nurses rostered for each shift. On morning shifts, the average number of minutes spent in indirect care activities was 97.43 minutes (see Table 5.18). Considering there were twelve nurses attending indirect activities this resulted in a figure of 1169 minutes of indirect care activities to be allocated to 29.8 neonatal patients. This resulted in the allocation of 39.23 minutes of indirect care to each neonate for morning shift. The same formula applied to afternoon shift where 89.33

minutes and night shift where 65.00 minutes were spent in indirect activities resulted in allocation of 36.86 minutes for afternoon shift and 26.82 minutes for night shift to each patient in the neonatal unit to provide for indirect nursing care activities.

The other component of indirect time which was observed during data collection was that period of time when the nurses are unavailable for care. Generally this related to tea breaks and personal needs. Once again the literature offers conflicting advice on acceptable times for the personal needs of the nurses. Meyer (1978) allowed 6% for personal time, while Hovenga (1985) accepted 15% in her study. Minyard, Wall and Turner (1986) accepted 20% as non productive time, but made the comment that some industrial engineers suggest 16% as a reasonable figure for non productive time. The New South Wales Nurses' (State) Award allows for two ten minute tea breaks and a thirty minute meal break on morning and afternoon shift, and two twenty minute breaks on night duty. This was seen to be fairly flexible during the observation period. Morning shift staff did not officially take an afternoon tea break, they took their tea break in the form of leaving ten minutes earlier. Sometimes due to busyness factor a tea break may be missed, on other times when the unit was quieter, longer tea breaks were taken. This supported Hancock's (1980) comments that nurses work at a speed necessary to complete the necessary work. During observation it was noted that time spent on tea breaks averaged 20.29 minutes and personal need breaks averaged 6.33 minutes, a combined average of 26.62 minutes, or 5.54% of available time per shift. (see Appendix 15). This supported Meyer's finding of 6% in 1978. For the

Neonatal Nursing Intensity System, no attempt has been made to build in a figure for personal time, or time when the nurses will be unavailable for care giving activities. It has been accepted that flexibility exists in the amount of time taken as personal breaks which is influenced by the busyness factor at that time. Calculation of nursing time available will be based on an eight hour shift.

6.3.5 Summary

As shown in Chapter 2, the literature does not offer consistent advice regarding allocation of time for indirect activities. This is due to the variety of definitions of, and inclusions in, this category of activities. This may be the result of differences in practice in the United States of America, Canada, Britain and Australia.

The results of observation and timing of indirect nursing activities within the neonatal unit have been discussed. It has been shown that the average percentage of a nurse's eight hour shift used in indirect care was 17.41%. It has also been shown that this is significantly higher on morning shift, being 20.30% than on afternoon shift which was 18.40% or night shift which was 13.54%. It has also been shown that when time required for indirect care activities is evenly distributed between patients, the total time required for nursing care is increased by 39.23 minutes on morning shift, 36.86 minutes on afternoon shift and 26.82 minutes on night shift. Personal time or non productive time for individual nurses has been discussed. This study has focussed on the indirect activities attended by clinical nurses in their everyday practice. Both units sampled

maintained administrative structures which allowed for a supernumary Nursing Unit Manager on each shift, therefore no attempt to quantify or include administrative activities has been made. Were unit policy to change significantly in this respect and clinical nurses take on administrative functions in their day, changes would need to be made to the calculations for indirect nursing activities.

The development of the Nursing Intensity System with consideration of indirect nursing activities is discussed in Chapter 7.

6.4 Expert Nurses' Judgement

6.4.1 Introduction

Sixteen expert nurses were asked to give their assessment of time taken to attend a variety of direct care nursing interventions. This data was collected to provide validity to the timed observations of direct care interventions obtained by activity sampling method. Thirty three frequently occurring nursing interventions were chosen for this part of the research.

6.4.2 Expert Nurses' Judgement to Validate Data Obtained by Activity Sampling Method

Table 5.20 illustrates the mean total time of the sixteen assessments together with the standard deviation and coefficient of variation. The complete data is shown in Appendix 17.

The intra-rater reliability of the sixteen expert nurses was tested by applying the Kendall Coefficient of Concordance, W = 0.972 (see Appendix 19) which showed that the data collected from the expert nurses was reliable to be used for validation of data collected by activity sampling method.

Pearson's Product Moment Correlation Coefficient was applied to the observer timed recordings and expert nurses' judgement to test reliability of the observer timed data, $r = 0.998$. A positive correlation between the two sets of data is shown, indicating that the observer timed data is valid to determine nursing hours required in the neonatal unit.

6.5 Summary

The aims and objectives of the study as outlined in Chapter 1, Section 1.4, have been met.

The aim of the study was to develop a patient classification system which may be used in staff scheduling within neonatal units. The development of the Neonatal Nursing Intensity System is shown in Chapter 7.

The objectives of the study were to determine the nursing hours required to provide direct and indirect nursing care within the neonatal unit and to validate that data. The results of data collection, statistical analysis and validation in relation to these objectives has been presented in Chapter 5 and discussed in this chapter.

CHAPTER SEVEN

THE NEONATAL NURSING INTENSITY SYSTEM

CHAPTER 7: THE NEONATAL NURSING INTENSITY SYSTEM

7.1 Introduction

In this section the development of the Neonatal Nursing Intensity System will be described. Educational processes necessary for successful implementation of the Neonatal Nursing Intensity System will be outlined and strategies for further validation of the System will be discussed.

7.2 The Neonatal Nursing Intensity System

The Neonatal Nursing Intensity System is designed to monitor utilisation of nursing hours within the neonatal unit, and to facilitate prediction of nursing hours required for oncoming shifts. The Neonatal Nursing Intensity System is a factor evaluation tool as defined by Abdellah and Levine (1979). Data used for the development of the Neonatal Nursing Intensity System (N.N.I.S.) has been presented in Chapter 5 and discussed in Chapter 6.

While it is accepted that predicting activity levels in intensive care areas is difficult, the Neonatal Nursing Intensity System has been designed to utilise knowledge of current needs to predict immediate short term requirements and validate the use of nursing resources retrospectively. The N.N.I.S. is designed to be simple to use and to require minimal nursing time to complete. To use the N.I.S.S., two forms are required, namely the Neonatal Nursing Intensity Tool

(see Figure 7.3) and the Neonatal Nursing Intensity Compilation Sheet (see Figure 7.5). The Neonatal Nursing Intensity Tool is designed to be completed by the nurses caring for the individual babies on a twenty four hour basis. The Neonatal Nursing Intensity Compilation Sheet is designed to be used by the Nursing Unit Manager will show the nursing hours required for all neonates in the unit on a daily basis and can be used to validate nursing resources required retrospectively and to predict future trends.

Foremost in the development of the Neonatal Nursing Intensity System has been considerations for simplicity, ease of use and avoidance of ambiguity. McGratty (1985) and Nagaprasanna (1988) both stated that ease of use is one of the most important factors of any tool designated to measure utilisation of nursing resources. Cuthbert (1983) considered criteria which was unambiguous as a necessary component of a patient classification tool.

7.2.1 Neonatal Nursing Intensity Tool

The Neonatal Nursing Intensity Tool (N.N.I.T.) is the document which is to be used by the nurses caring for the individual babies and completed each shift for a twenty four hour period. The N.N.I.T. documents nursing interventions which may be attended. On the reverse side are instructions for use. See Figure 3 and Figure 4.

The N.N.I.T. is divided into three main areas. In the first area nursing interventions are grouped together into categories of similar activities. These

categories are discussed in section 7.2.2. The second section provides a choice of frequency of attendance for each intervention and a coded point system, based on time required, for each intervention and each frequency. The selected frequencies of attendance for individual interventions are discussed in section 7.2.3, and the coded point system is shown in section 7.2.4. The third area of the N.I.T.T. provides for the nurses to document nursing interventions attended during the twenty four hour period. Sections for morning, afternoon and night shift are available. The nurse will choose the appropriate frequency for the intervention attended and document the appropriate calculated code in this area.

Included in the N.N.I.T. is a calculated weighted factor which represents indirect nursing activities. The coding system used for the indirect activities is the same as that used for direct nursing activities. Data used to calculate the indirect activity factor has been discussed in Chapters 5 and 6. The weighted factor for indirect activities as shown on the N.N.I.T. is discussed in section 7.2.5. Areas are included at the bottom of the Neonatal Nursing Intensity Tool to record the total numbers in each of the columns for each shift and for the total 24 hours.

7.2.2 Categories in the Neonatal Nursing Intensity Tool

The Neonatal Nursing Intensity Tool has nine categories of activities, these are, Observations, Parenteral Fluids, Enteral Fluids, Medications, Respiratory Care, Hygiene and General Care, Parent Education, Admission and Discharge, and Others. These categories are reflective of the categories used for data collection

as discussed in Chapters 5 and 6, but have been further developed for ease of use and logical presentation. Within each of these categories are individual direct care nursing interventions together with a choice of frequencies of attendance and allocated code. Interventions included in each of the categories are described in section 7.3.1.

7.2.3 Frequency of Attendance of Interventions

Frequency of possible attendance of nursing interventions has been provided in three ways. Firstly for those interventions which generally occur on a hourly basis, for example hourly, second hourly, third hourly and fourth hourly, the facility to choose these frequencies has been offered. Secondly, for those interventions which do not follow a set hourly routine, a format which allows documentation of interventions by number of attendances, for example once, twice, three or four times per shift, has been allowed. Thirdly, for those interventions which would most likely occur only once or twice per shift or per day, the facility to document one or two attendances has been included. This method of recording the frequency of attending nursing interventions has been selected to provide flexibility, for ease of use and to reduce possible ambiguity.

7.2.4 Coding System for The Neonatal Nursing Intensity Tool

The coding system developed in the Neonatal Nursing Intensity Tool has been designed with simplicity and ease of use as major considerations. For each

intervention included on the N.N.I.T., a coded point system, based on time required to attend each intervention and represented by a single figure, has been provided. This point system equates exactly to minutes of care, one point being equal to one minute of care. This makes conversion of the total figures on the N.N.I.T. to nursing hours utilised a simple calculation. The coded point system has been calculated in one of two ways. Where the activity occurs on a frequency based on hours (1\24, 2\24, 3\24 or 4\24) the mean time observed for that intervention as shown in Chapter 5 has been multiplied by the frequency this would be attended in 24 hours (24 for hourly, 12 for second hourly, 8 for third hourly, and 6 for fourth hourly) and divided by three, to represent three shifts in 24 hours, to calculate the average time for each frequency per shift. Time required has been converted to the nearest complete minute.

Where the facility to document by attendance has been offered (either once, twice, three or four times), the mean time observed as shown in Chapter 5 has been multiplied by that frequency to calculate the code for each frequency of attendance. Times required have been converted to the closest complete minute. This coding method is consistent with the description offered by Dijkers and Paradise (1986). The documented total of each intervention for each shift, and for the twenty four hours, can then be totalled and divided by 60 (minutes per hour) to calculate the nursing hours per day used or required.

7.2.5 Indirect Activity Component

The Neonatal Nursing Intensity System has provided for the inclusion of indirect nursing activities. This is represented by the inclusion of a weighted factor, based on time required, for each shift. This indirect activity component is outlined in Section 7.3.2.

7.2.6 The Neonatal Nursing Intensity Compilation Sheet

The Neonatal Nursing Intensity Compilation Sheet (N.N.I.C.S.) is designed to be a record of total activities within the neonatal unit for a 24 hour period. Facility to document nursing hours required for each neonate, for each shift and the total for 24 hours is provided. The total nursing time requirement for the unit can then be shown for each shift, and for the twenty four hours. Nursing hours available can be included, and any variance between the two can be determined. The Neonatal Nursing Intensity Compilation Sheet is designed to be an administrative summary, useful for validating use of nursing resources retrospectively and predicting trends. See Figure 5.

7.3 The Neonatal Nursing Intensity Tool

The Neonatal Nursing Intensity Tool (N.N.I.T.) is designed to be used by the nurses caring for the individual babies within the neonatal unit (see Figure 3). The N.N.I.T. is completed for each baby each twenty four hours, and has a section for each shift to complete. On the reverse side are directions for use (see

Figure 7.4). The Neonatal Nursing Intensity Tool includes individual direct care nursing interventions, with a choice of frequencies of attendance. A coded point system based on the time required to attend every intervention for each frequency is included. Consideration of indirect nursing activities has been provided for by the inclusion of a weighted factor for each shift.

7.3.1 Direct Care Interventions

The N.N.I.T. comprises individual direct care interventions with the facility to choose the appropriate frequency and document the calculated code for each intervention and frequency attended. These direct care activities have been organised into categories for simplicity and logical order. The categories are: observation, parenteral fluids, enteral fluids, medications, respiratory care, hygiene and general care, parent education, admission and discharge, and others. The method of calculating frequencies of attendance of each intervention and the coded point system have been previously discussed in sections 7.23 and 7.24. The development of the Neonatal Nursing Intensity Tool in relation to direct care nursing interventions is discussed in the following subsections.

7.3.1.1 Observations Category

The Neonatal Nursing Intensity Tool has provision for four interventions within the category of observations. These are: observation of vital signs of the ventilated and non ventilated infant, blood gas analysis and heel prick blood glucose monitoring. Blood glucose monitoring has been specified as heel prick to

delineate these as separate interventions. Those babies who have arterial lines in place will have blood glucose monitoring attended as part of blood gas sampling, to reduce the trauma of multiple sampling, and this has been included in that total intervention.

Observations of vital signs is routinely attended on an hourly basis and may range in frequency from hourly to fourth hourly. For the ventilated infant two frequencies, namely hourly and second hourly, have been included. For the non ventilated infant four frequencies have been included, these are hourly, second hourly, third and fourth hourly. For blood gas analysis and heel prick blood glucose, frequency by number of attendances has been provided for rather than by frequency of hours. Facility has been provided for four separate attendances of these interventions. In the event that either of these interventions were attended more frequently than four times, it is a simple matter to multiply the code for one attendance by the appropriate frequency and document that. This possibility has been addressed in the instructions for use. Table 7.1 shows the time required per shift for each intervention, and for each frequency of attendance.

Table 7.1: Time Required for Interventions at Selected Frequencies per 8 Hour Shift - Observations Category

Intervention	Average Observed Time Per Single Attendance (Minutes)	Time Required per 8 Hour Shift at Selected Frequencies (in Minutes)			
		1\24	2\24	3\24	4\24
Observations: Ventilated Neonate	2.50	20	10	--	--
Observations: Non ventilated Neonate	1.75	14	7	5	4

Intervention	Average Observed Time Per Single Attendance (Minutes)	Time Required per 8 Hour Shift at Selected Frequencies (in Minutes)			
		(X 1)	(X 2)	(X 3)	(X 4)
Blood Gas Analysis	7.0	7	14	21	28
Heel Prick Blood Glucose Monitoring	4.0	4	8	12	16

Code: 1\24=hourly; 2\24=second hourly; 3\24=third hourly; 4\24=fourth hourly. (X 1)=once; (X 2)=twice; (X 3)=three times; (X 4)=four times.

Results of observational data presented in Chapter 5 (see Table 5.5) indicate an average time of 2.5 minutes per attendance for observing the vital signs of the ventilated neonate. Two frequencies of attendance have been provided for, in line with unit policy, namely hourly and second hourly. It can be seen from Table 7.1 that the nursing time in minutes required per shift for this intervention when attended hourly is 20 minutes per shift, and 10 minutes per shift when

attended second hourly. As shown in Table 5.5, an average time of 1.75 minutes per attendance is required for observing the vital signs of the non ventilated infant. Four frequencies of attendance are provided for on the N.N.I.T., these being hourly, second hourly, third hourly and fourth hourly. As shown in Table 7.1, nursing time per shift in minutes required for this intervention when attended hourly is 14 minutes. When attended second hourly, seven minutes is required, five minutes if attended third hourly and four minutes if attended fourth hourly.

Data presented in Chapter 5 (see Table 5.5) indicate an average time of 6.94 minutes per attendance for arterial blood gas sampling and 7.25 minutes for peripheral blood gas sampling. As the mean figures for both of these interventions, when taken to the nearest complete minute, converted to 7 (minutes) per attendance, only one inclusion for blood gas analysis was provided. Four frequencies of attendance have been provided for, namely once, twice, three or four times. Nursing time in minutes per shift for this intervention as shown in Table 7.1 is 14 minutes for two attendances, 21 minutes for three attendances and 28 minutes when four blood gas analysis have been attended.

An average time of 4.00 minutes per attendance for blood glucose monitoring has been shown in Table 5.5. For the N.N.I.T., four frequencies of attendance are provided for, these being once, twice, three or four times. As shown in Table 7.1, nursing time in minutes required for two attendances is 8 minutes, three attendances 12 minutes and for four attendances 16 minutes is required.

7.3.1.2 Parenteral Fluids Category

The Neonatal Nursing Intensity Tool provides three interventions to be attended in the category of parenteral fluids. These are intravenous\umbilical, arterial and central venous line fluid changes. For these interventions, frequency by attendance has been provided for rather than by frequency of hours. Facility has been provided for four separate attendances of each intervention. Extensive frequencies were provided for convenience and ease of use. It is not uncommon for intravenous fluids to be changed more than once per day due to electrolyte and glucose management needs. Table 7.2 shows the required minutes of nursing time per shift for each intervention and each of the calculated frequencies.

Table 7.2: Time Required for Interventions at Selected Frequencies per 8 Hour Shift - Parenteral Fluids Category

Intervention	Average Observed Time Per Single Attendance (Minutes)	Time Required per 8 Hour Shift at Selected Frequencies (in Minutes)			
		(X 1)	(X 2)	(X 3)	(X 4)
Intravenous\Umbilical Fluid Line Change	16	16	33	49	66
Arterial Line Change	12	12	24	35	47
Central Venous Line Fluid Change	39	39	78	118	157

Code: (X 1) = once; (X 2)=twice; (X 3) = three times; (X 4) = four times.

Results of observational data presented in Chapter 5 (see Table 5.6) indicate an average time of 16.43 minutes per attendance for changing venous and umbilical

fluid lines. Multiplying the single attendance figure by appropriate frequency indicates a time requirement of 33 minutes for two attendances, 49 minutes for three attendances and 66 minutes for four attendances. Data presented in Table 5.6 indicate an average time of 11.80 minutes required for changing arterial line fluids. As shown in Table 7.2, multiplying the mean for single attendance by the appropriate frequency shows a time requirement of 24 minutes for two attendances, 35 minutes for three attendances and 47 minutes for four attendances. As shown in Chapter 5 (see Table 5.6) an average time of 39.19 minutes was required to change central venous line fluids. As shown in Table 7.2, multiplying this single attendance figure of 39.19 by the appropriate frequency indicates a time estimation of 78 minutes for two attendances, 118 minutes for three and 157 minutes for four attendances.

7.3.1.3 Enteral Fluids Category

The Neonatal Nursing Intensity Tool has provision for two interventions within the category of enteral fluids. These interventions are bottle and gavage feeding. Gavage feeding is generally attended on an hourly basis and may range in frequency from hourly to third hourly. On the N.N.I.T., facility has been provided for recording frequency of gavage feeding on an hourly basis, with the frequency ranging from hourly to third hourly. Bottle feeding generally occurs on demand, therefore frequency by attendance has been provided for. Facility has been provided for four separate attendances. Table 7.3 shows the required minutes of nursing time per shift for each of the calculated frequencies.

Table 7.3: Time Required for Interventions at Selected Frequencies per 8 Hour Shift - Enteral Fluids Category

Intervention	Average Observed Time Per Single Attendance (Minutes)	Time Required per 8 Hour Shift at Selected Frequencies (in Minutes)		
		1\24	2\24	3\24
Gavage Feeding (1\24)	8.06	64	--	--
Gavage Feeding (2\24, 3\24)	16.00	--	64	43

Intervention	Average Observed Time Per Single Attendance (Minutes)	Time Required per 8 Hour Shift at Selected Frequencies (in Minutes)			
		(X 1)	(X 2)	(X 3)	(X 4)
Bottle Feeding	27.56	28	55	83	110

Code: 1\24 = hourly; 2\24 = second hourly; 3\24 = third hourly; (X 1) = once; (X 2) = twice; (X 3) = three times; (X 4) = four times.

Results of observational data presented in Chapter 5 (see Table 5.6) indicate an average time of 8.06 minutes per attendance for hourly gavage feeding and 16.00 minutes for second or third hourly gavage feeding. Table 7.3 shows the nursing time required in minutes per shift for hourly gavage feeding will be 64 minutes. It can be seen that second hourly gavage feeding requires 64 minutes per shift and third hourly feeding requires 43 minutes. Data presented in Table 5.6 show an

average time of 27.56 minutes required per one bottle feeding. Four frequencies of attendance have been provided for, these being one, two, three or four bottle feedings. Multiplying the mean time of 27.56 for one bottle feeding by the number of attendances shows that two bottle feedings will require 55 minutes of nursing time, 83 minutes for three and 110 minutes if four feedings were offered.

7.3.1.4 Medications Category

The Neonatal Nursing Intensity Tool has provision for three interventions within the category of medications. These include intravenous bolus medications, intravenous infusion medications and oral medications. For each medication administration, frequency by attendance has been provided. Facility has been provided for four separate attendances of each intervention. Table 7.4 shows the required minutes of nursing time per shift for each frequency.

Table 7.4: Time Required for Interventions at Selected Frequencies per 8 Hour Shift - Medications Category

Intervention	Average Observed Time Per Single Attendance (Minutes)	Time Required per 8 Hour Shift at Selected Frequencies (in Minutes)			
		(X 1)	(X 2)	(X 3)	(X 4)
Intravenous Bolus	13.38	7	13	20	27
Intravenous Infusion	11.35	11	23	34	45
Oral	2.44	2	5	7	10

Code: (X 1) = once; (X 2) = twice; (X 3) = three times; (X 4) = four times.

Data presented in Chapter 5 (see Table 5.8) indicate an average time of 13.38 minutes per intravenous bolus medication administration. As discussed in Chapter 6, intravenous bolus medications observed being administered generally consisted of two medications given consecutively. For one medication administration, the mean time of 13.38 minutes was divided by two (6.69) and a figure of seven minutes accepted. Multiplying this modified figure of 7 by the number of attendances shows a time estimation of 20 minutes for three administrations and 27 minutes if four medications were administered. The observed mean of 13 minutes was accepted as the time requirement for two medication administrations. Data presented in Table 5.8 indicate an average time of 11.35 minutes per single infusion medication administration. As shown in Table 7.4, multiplying the mean time for single attendance of 11.35 by the number of attendances indicates a time requirement of 23 minutes for two infusions, 34 minutes for three and 45 minutes if four infusions were administered. As shown in Table 5.8, an average time of 2.44 minutes was required per oral medication administration. This converted to the nearest complete minute was recorded as 2 minutes for one oral medication. Multiplying the mean time of 2.44 by the number of attendances resulted in a calculation of 5 minutes for two oral medications, 7 minutes for three and 10 minutes if four medications were given.

7.3.1.5 Respiratory Care Category

The Neonatal Nursing Intensity Tool has provision for three interventions in the category of respiratory care. These are endotracheal (E.T.T.) and nasopharyngeal tube toilets (N.P.T.), and chest physiotherapy. These

interventions are attended on an hourly frequency, and may range in frequency from hourly to fourth hourly, depending on need for clearance of pulmonary secretions. For each respiratory care activity, attendance by hours of frequency has been provided, these being hourly through to fourth hourly. Table 7.5 shows the required nursing time per shift for each intervention and each of the calculated frequencies.

Table 7.5: Time Required for Interventions at Selected Frequencies per 8 Hour Shift - Respiratory Care Category

Intervention	Average Observed Time Per Single Attendance (Minutes)	Time Required per 8 Hour Shift at Selected Frequencies (in Minutes)			
		1\24	2\24	3\24	4\24
E.T.T. Toilet	6.06	48	24	16	12
N.P.T. Toilet	3.53	28	14	9	7
Chest Physiotherapy	3.00	24	12	8	6

Code: 1\24 = hourly; 2\24 = second hourly; 3\24 = third hourly; 4\24 = fourth hourly.

Data presented in Chapter 5 (see Table 5.7) indicate an average of 6.06 minutes of nursing time per single attendance for endotracheal tube toilet. Table 7.5 shows that to attend hourly E.T.T. toilet, 48 minutes of nursing time per shift will be required. For second hourly toilets 24 minutes will be necessary, third hourly toilets will require 16 minutes per shift, and fourth hourly 12 minutes. Data presented in Table 5.7 indicate an average time of 3.53 minutes per

attendance for nasopharyngeal tube toilet. As shown in Table 7.5, to attend hourly N.P.T. toilets, 28 minutes of nursing time per shift will be required. Second hourly toilets will result in usage of 14 minutes while third hourly toilets will require 9 minutes per shift. Attending N.P.T. toilets fourth hourly will require 7 minutes of nursing time per shift. As shown in Table 5.7, an average time of 3.00 minutes was required to attend chest physiotherapy. As shown in Table 7.5, when attending hourly chest physiotherapy, 24 minutes of nursing time will be utilised. For second hourly physiotherapy, 12 minutes will be required, for third hourly 8 minutes, and fourth hourly physiotherapy will result in usage of 6 minutes of nursing time per shift.

7.3.1.6 Hygiene\General Care Category

The Neonatal Nursing Intensity Tool has provision for seven interventions within the category of hygiene and general care. These include general care activities, comfort and settling activities, bathing or sponging, attending dressings and headbox or ventilator tubing change. General nursing care of the neonate is routinely attended third or fourth hourly. Provision for two comfort and settling activities has been made, these include simple and involved activities. Simple activities included stroking and soothing, more involved activities included cuddling, relaxation massage or relaxation bathing. Directions for correct selection have been included on the N.N.I.T. For comfort\settling activities four frequencies have been provided, which should allow flexibility for all instances. For the other activities in this category the ability to select by attendance has been included. This has been limited to two occasions as it would be unlikely to attend

these interventions more than twice per day or twice per shift. However, if the occasion arose when any of these interventions were attended more than twice per shift, it would be possible to indicate that on the Tool, and this possibility has been provided for in the instructions for use. Table 7.6 shows the required minutes of nursing time per shift for each frequency.

Table 7.6: Time Required for Interventions at Selected Frequencies per 8 Hour Shift - Hygiene and General Care Category

Intervention	Average Observed Time Per Single Attendance (Minutes)	Time Required per 8 Hour Shift at Selected Frequencies (in Minutes)	
		3\24	4\24
General Care	13.50	36	27

Intervention	Average Observed Time Per Single Attendance (Minutes)	Time Required per 8 Hour Shift at Selected Frequencies (in Minutes)			
		(X 1)	(X 2)	(X 3)	(X 4)
Comfort\Settling Simple	7.76	8	16	23	31
Comfort\Settling Involved	19.63	20	39	59	79
Bath	21.44	21	42		
Sponge	15.25	15	30		
Dressings	14.00	14	28		
Ventilator\ Headbox Tubing Change	10.00	10	20		

Code: 3\24=third hourly; 4\24=fourth hourly. (X 1)=once; (X 2)=twice; (X 3) = three times; (X 4) = four times.

Data presented in Chapter 5 (see Table 5.7) indicate an average time of 13.94 minutes per attendance for general nursing care activities for the ventilated infant and 13.06 minutes per attendance for the non-ventilated infant. As results of observations showed only .8 of one minute difference, and as simplicity is desirable, only one selection for general nursing care activities has been provided. Two frequencies of attendance were provided for, these being third and fourth hourly. To calculate the nursing time in minutes for third hourly general care activities the mean times of both interventions (13.94 and 13.06) were averaged (13.5), multiplied by eight (attendances per day) and divided by three (shifts in 24 hours) to arrive at an estimated usage of 36 minutes for each shift. Four hourly time requirement was calculated by multiplying the average of both means (13.5) by six (attendances per day) and dividing by three (shifts in 24 hours) to arrive at a time per shift of 27 minutes.

Table 7.6 shows the required minutes of nursing time per shift for comfort and settling activities for each calculated frequency. Data presented in Table 5.7 shows an average time of 7.76 minutes time for simple comfort and settling activities, and 19.63 minutes for more involved episodes. Table 7.6 illustrates that comfort and settling activities have the potential to require a large commitment of nursing time depending on the needs of the individual neonate. Results presented in Chapter 5 (see Table 5.7) indicate an average time of 21.44 minutes required per bath and 15.25 for sponge bath. Table 7.6 shows that for two baths 42 minutes would be required, while two sponge baths would utilise 30 minutes of nursing time. Shown in Table 5.8 is the average time of 14.00

minutes to attend a dressing. Two dressings would require 28 minutes of nursing time as shown in Table 7.6. Results presented in Table 5.7 illustrate an average time of 10.07 for headbox tubing change and 10.44 minutes per ventilator tubing change. As both of these interventions revert to 10 minutes when taken to the nearest complete minute, they have been combined for simplicity and ease of use.

7.3.1.7 Parent Education Category

The Neonatal Nursing Intensity System has provision for two interventions within the category of parent education. These include education to assist with care, and parentcraft education. Education to assist with care includes activities such as oral and eye toilets, and nappy changing. Parentcraft education includes bathing demonstrations, feeding and management of oxygen therapy. Directions for correct selection are included in the instructions for the N.N.I.T. For the parent education activities, the ability to select two attendances has been included. It is unlikely that these would be attended more that twice per shift. However, if this occasion arose, it would be possible to indicate that on the tool by selecting the code for one attendance and multiplying by the appropriate frequency. This consideration has been included in the instructions for use. Table 7.7 shows the required minutes of nursing time per shift for each education session for each frequency.

Table 7.7: Time Required for Interventions at Selected Frequencies per 8 Hour Shift - Parent Education Category

Intervention	Average Observed Time Per Single Attendance (Minutes)	Time Required per 8 Hour Shift at Selected Frequencies (in Minutes)	
		(X 1)	(X 2)
Assisting with Care Education	10.31	10	21
Parentcraft Education	22.94	23	46

Code: (X 1) = once; (X 2) = twice

Table 5.9 indicates one episode of parent education to assist with care required 10.31 minutes while the more involved parentcraft education session required 22.94 minutes. Table 7.7 illustrates that education to assist with care would result in usage of ten minutes for one session and 21 minutes for two sessions. Parentcraft education sessions would require 23 minutes for a single attendance and 46 minutes for two sessions.

7.3.1.8 Other Activities Category

The Neonatal Nursing Intensity Tool has provision for nine interventions within the category of Other Activities. These include venous or arterial cannulation, catheterisation (either umbilical artery, umbilical venous or central venous), assisting with intubation, X-Ray or ultrasound, extubation and weight estimation. For these activities the ability to select two attendances have been provided for.

It would be unlikely to attend these interventions more than twice per shift. However, if this occasion arose it would be possible to indicate that on the Tool. Table 7.8 shows the required minutes of nursing time per shift for each intervention and each of the calculated frequencies.

Table 7.8: Time Required for Interventions at Selected Frequencies per 8 Hour Shift - Others Category

Intervention	Average Observed Time Per Single Attendance (Minutes)	Time Required per 8 Hour Shift at Selected Frequencies (in Minutes)	
		(X 1)	(X 2)
Venous Cannulation	13.00	13	26
Arterial Cannulation	16.91	17	34
Catheterisation	29.95	30	60
X-Ray	8.23	8	16
Ultrasound	10.10	10	20
Intubation	25.80	26	52
Extubation	20.50	21	42
Weigh	9.33	9	18

Code: (X 1) = once; (X 2) = twice

Results presented in Chapter 5 (see Table 5.6) indicate an average time of 13.00 for assisting with venous cannulation. Table 7.8 shows that 26 minutes of nursing time would be required if cannulation was attended twice on a shift. Results presented in Table 5.6 indicate an average time of 16.91 for assisting with arterial cannulation. As shown in Table 7.8, seventeen minutes would be required for one arterial cannulation, this time requirement would be doubled

where this attended twice. Data presented in Chapter 5 (see Table 5.6) indicate an average time of 32.10 for assisting with central venous catheterisation and 27.80 for umbilical catheterisation. As these activities are not regular occurrences, and for ease of use, the two have been combined. To calculate the code the average of both means was obtained (29.95) and accepted as thirty minutes for one attendance and 60 minutes for two.

As shown in Table 5.8, an average time of 8.23 minutes is required for assisting with X-Ray. As shown in Table 7.8, assisting with two X-Rays would require sixteen minutes of nursing time. Data presented in Chapter 5 (see Table 5.8) indicate an average time of 10.10 minutes for assisting with ultrasound. It can be seen in Table 7.8 that two ultrasounds would require twenty minutes of nursing time. As shown in Table 5.8 an average time of 25.80 minutes was required for assisting with intubation. Table 7.8 illustrates that to assist with two intubations would require double this amount of time. Shown in Table 5.8 is the average time of 20.50 minutes required for extubation. It is unlikely that intubation or planned extubation would be attended more than once per shift, but two attendances have been included for continuity. Results of observations presented in Chapter 5 (see Table 5.5) indicate an average time of 10.53 minutes for weight estimation of the ventilated neonate, and 8.13 for the non ventilated neonate. As weight estimation occurs normally each third day, and the two show a variance of 2.4 minutes (0.5% of available time per shift) these have been combined for convenience and ease of use. The average of both means was determined (9.33)

and accepted as nine minutes of nursing time for one attendance and eighteen minutes for two.

7.3.1.9 Admission or Discharge Category

The Neonatal Nursing Intensity Tool has provision for three interventions in the category of admission and discharge. These include admission of a ventilated and non ventilated infant, and discharge. Within this category the ability to select one attendance only has been included. Table 7.9 shows the required minutes of nursing time per shift for each of the calculated frequencies.

Table 7.9: Time Required for Interventions at Selected Frequencies per 8 Hour Shift - Admission and Discharge Category

Intervention	Average Observed Time Per Single Attendance (Minutes)	Time Required per 8 Hour Shift at Selected Frequencies (in Minutes) (X 1)
Admission - Ventilated Neonate	**55.93**	**56**
Admission - Non ventilated Neonate	**33.93**	**34**
Discharge	**57.00**	**57**

Code: (X 1) = once

Results shown in Chapter 5 (see Table 5.5) illustrate an average time of 33.93 minutes for admission of the non ventilated infant, and 53.93 minutes for the

ventilated infant. These have been taken to the nearest complete minute, being 54 for the ventilated infant and 34 for the non ventilated infant. Discharge from the neonatal unit was shown (see Table 5.9) to require an average of 57.00 minutes. For the N.N.I.T. this has been converted to a code of 57.

7.3.2 Indirect Care Component

The Neonatal Nursing Intensity System provides for a component of indirect care activities. This is represented by a weighted factor included in the total for each shift. As shown in Table 5.17, the average percentage of the nurse's shift spent in indirect activities was 17.41%. This was further broken down to show expenditure of 20.30% of time on morning shift, 18.40% on afternoon shift and 13.54% on night shift. As discussed in Chapter 6, indirect activities have been allocated equitably to all neonates in the unit regardless of acuity. This has resulted in a weighted factor of 39.23 minutes being added to morning shift, 35.86 minutes being added for afternoon shift and 26.82 minutes being added for night shift.

7.3.3 Summary

The development of the Neonatal Nursing Intensity Tool (N.N.I.T.) has been shown. The (N.N.I.T.) is shown in Figure 7.3, and the instruction for use shown on the reverse side of the (N.N.I.T.) are shown in Figure 7.4.

Figure 7.3 NEONATAL NURSING INTENSITY TOOL

Patient Identification									Date:		
Interventions	**Code:**								**A.M.**	**P.M.**	**N.D.**
Observations: Attend per Shift											
Observations: Ventilated Neonate	1/24	20	2/24	10							
Observations: NonVentilated Neonate	1/24	14	2/24	7	3/24	5	4/24	4			
Blood Gas Analysis	1	7	2	14	3	21	4	28			
Heel Prick Blood Glucose	1	4	2	8	3	12	4	16			
Parenteral Fluids: Change per Shift											
Intravenous\Umbilical	1	16	2	33	3	49	4	66			
Arterial	1	12	2	24	3	35	4	47			
C.V.L.	1	39	2	78	3	118	4	157			
Enteral Fluids: Offer per Shift											
Bottle	1	28	2	55	3	83	4	110			
Gavage	1/24	64	2/24	64	3/24	43	4/24	32			
Medications: Attend per Shift											
I.V. Bolus	1	7	2	13	3	20	4	27			
I.V. Infusion	1	11	2	23	3	34	4	45			
Oral	1	2	2	5	3	7	4	10			
Respiratory Care: Attend per Shift											
E.T.T. Toilet	1/24	48	2/24	24	3/24	16	4/24	12			
N.P.T. Toilet	1/24	28	2/24	14	3/24	9	4/24	7			
Chest Physio	1/24	24	2/24	12	3/24	8	4/24	6			
Hygiene\General Care: Attend per Shift											
General Care					3/24	36	4/24	27			
Comfort\Settling – Simple	1	8	2	16	3	23	4	31			
Comfort\Settling – Involved	1	20	2	39	3	59	4	79			
Bath	1	21	2	43							
Sponge	1	15	2	31							
Dressings	1	14	2	28							
Ventilator\Headbox Tubing Change	1	10	2	20							
Others: Attend per Shift											
Venous Cannulation	1	13	2	26							
Arterial Cannulation	1	17	2	34							
Catheterisation (UA,UV,CVL)	1	30	2	60							
X–Ray	1	8	2	16							
Ultrasound	1	10	2	20							
Intubation	1	26	2	52							
Extubation	1	21	2	41							
Weigh	1	10	2	19							
Parent Education: Attend per Shift											
Assist with Care	1	10	2	21							
Parentcraft	1	23	2	46							
Admission\Discharge											
Admission Ventilated	1	54									
Admission Non Ventilated	1	34									
Discharge	1	57									
	Weighted Factor (Add)								**39**	**37**	**27**
	TOTAL PER SHIFT										
	TOTAL PER DAY										

Figure 7.4: The Neonatal Nursing Intensity Tool - Reverse Side - Instructions for Use

The Neonatal Nursing Intensity Tool (N.N.I.T.) may be attended throughout the shift and must be completed close to the end of the shift.

Select the interventions, and the frequency with which you have attended these interventions, during your shift. Choose the coded figure (in the shaded section immediately to the right of the chosen frequency) and document this figure in the space allocated for your shift. At the end of your shift, add the figures in the column, include the weighted figure and document this total in the space provided at the bottom of the N.N.I.T.

If you find you attend any intervention in the "others", "parent education" or "hygiene" category more times than provided for (eg, dressings, X-Ray or parent education three times in your shift) select the code for one attendance and multiply that by the number of times you attended this and then document this figure in the appropriate spot. (For example: X-Ray attended three times - select code 8, multiply this by three to give 24. Document the figure 24 in the appropriate area and note on the N.N.I.T. that this has occurred by marking X3 next to X-Ray).

Note: **Parentcraft education** includes teaching bathing, feeding, oxygen management or wound dressings (e.g. colostomy).
Assisting with care education include teaching the parents to attend eye, oral and umbilical care, and nappy changing.

Simple comfort\settling activities include stroking and gentle speech.
Involved comfort\settling activities include cuddling, relaxation bathing or relaxation massage.

There are examples of completed N.N.I.T. forms in the Neonatal Nursing Intensity System Resource Package in the ward.

7.4 The Neonatal Nursing Intensity Compilation Sheet

The Neonatal Nursing Intensity Compilation Sheet (N.N.I.C.S.) is a one page administrative summary of the nursing hours required and available on a daily basis (see Figure 7.5).

The facility is available to document the calculated nursing hours required for each baby for each shift, and for the twenty four hours. The (N.N.I.C.S.) has areas to document:

* nursing hours required, per shift and per twenty four hours,
* nursing staff required per shift and per twenty four hours,
* nursing staff available per shift and per twenty four hours,
* any variance between nursing staff available and required per shift and per twenty four hours.

Instructions for calculating each of these, together with examples are shown on the reverse side (see Figure 7.6).

Figure 7.5

NEONATAL NURSING INTENSITY SYSTEM COMPILATION SHEET

Date: ______________________________

Name	Morning	Afternoon	Night	Total

Totals:	Morning	Evening	Night	Total
TOTAL CODES				
NHPPD				
RN Required				
RN Available				
Variance				

Figure 7.6: The Neonatal Nursing Intensity Compilation Sheet - Reverse Side - Instructions for Use

1 To calculate the nursing hours per patient day (N.H.P.P.D). required, divide the calculated code by 60 (minutes per hour).

example: code for 24 hours = $\frac{692}{60}$ = 11.5 N.H.P.P.D.
minutes per hour

2 To calculate nursing staff required per day, divide the N.H.P.P.D. by 8 (an eight hour shift).

example: N.N.P.P.D required = $\frac{11.5}{8}$ = 1.43 R.N.
R.N. hours available

3 To calculate nursing hours available, multiply the number of registered nurses rostered by 8 (hours per nurse).

example: 12 (R.N.) X 8 (hours) = 96 nursing hours available.

4 To calculate the variance, deduct the number of nurses available from the number of nurses required.

example: R.N. required = $\frac{16.4}{15.0}$ = 1.04 R.N. deficit
R.N. available =

7.5 Use of the Neonatal Nursing Intensity System

The Neonatal Nursing Intensity System will be used by clinical nurses and nursing administration. The clinical nurse will use the Neonatal Nursing Intensity Tool and will select interventions attended on each shift and document the calculated code for each intervention in the space provided. At the end of the shift this will be totalled to show a code for each shift, and at the end of the day for the twenty four hours. This required two minutes of nursing time when trialled by the researcher. At the commencement of each morning shift the Nursing Unit Manager will receive all the N.N.I.T. forms and transcribe these to the Neonatal Nursing Intensity Compilation Sheet for each shift and for the twenty four hours. The Nursing Unit Manager will then calculate the registered nurses required, available and any variance between the two. When trialled by the researcher, this activity took 8 minutes. For those Nursing Unit Managers with access to a personal computer, it would be possible to computerise this aspect of the Neonatal Nursing Intensity System. The information would then be available for predicting staffing needs for oncoming shifts (e.g. replacement of sick leave) and for validating use of resources.

7.6 Education Necessary for Implementation of the Neonatal Nursing Intensity System

The implementation of the Neonatal Nursing Intensity System would be delegated to one person who was knowledgable about the System. The education processes for implementation of the Neonatal Nursing Intensity System has been designed to

provide education for the three groups of people who must be involved in the use of the System. These are:

* the nurses who will be responsible for using the system,
* the nurse administrators who will be responsible for interpreting the system,
* the educators who will be responsible for teaching the system to new staff.

7.6.1 The Clinical Nurses

A series of structured education sessions will be held with the clinical nurses. These sessions will deal with use of the system, selecting the more difficult interventions to interpret, such as comfort and settling activities and parent education. Follow up sessions with the clinical nurses will occur daily on each shift for the first week, then weekly for one month, and then as necessary to ensure understanding is complete. These sessions would be flexible depending on need. A resource package will be provided for the clinical area detailing comprehensive instructions for use of the system (see Appendix 20). The instructions for use have been provided on the back of the N.I.T.T. for easy consultation.

7.6.2 The Nurse Administrators

In depth education would be attended for the nurse administrators responsible for interpreting the N.I.S.S. This would include use of the Neonatal Nursing Intensity Tool and the Neonatal Nursing Intensity Compilation Sheet. Follow up

sessions with the administrators would be attended daily for the first week, weekly for one month and then as necessary. Access to the implementation coordinator would need to be flexible during the implementation period. A resource package would be provided for the administrators to reinforce the aspects addressed in the education sessions (see Appendix 21).

7.6.3 The Educators

The educators would be involved in the sessions for clinical nurses where use of the System and interpretation of the criteria would be explained. A copy of the resource package developed for the unit would be made available to them for future use (See Appendix 20).

7.6.4 Summary

Processes for education of all staff prior to implementation of the N.I.S.S. have been outlined. These education sessions and resources would ensure smooth implementation of the N.I.S.S. and are consistent with Giovanetti and Mayer's (1984) theories on the implementation of patient classification systems.

7.7 Strategies Necessary for Validation of the Neonatal Nursing Intensity System

7.7.1 Introduction

The Neonatal Nursing Intensity System will require further validity and reliability testing as a patient classification system before staff scheduling is able to be adjusted according to the data generated. The methods for testing validity and reliability will be shown in this section.

7.7.2 Validity

Further validity testing of the Neonatal Nursing Intensity System will be attended three months after implementation of the System into the clinical area. A time span of three months has been accepted to allow education for the use of the System to be completed. The three methods of validity testing will be outlined below.

7.7.2.1 Expert Judgement

A committee of five nurses expert in the field of neonatal nursing will be convened. The role of this panel will be to review the timings allocated to the direct and indirect nursing activities. This will be done in conjunction with other monitoring processes. Giovanetti and Mayer (1984) commented that nursing practice standards are, in a large part, a consensus of professional nurses judgement and that their expert advice should also be employed in determining resources required to maintain the established standards of care.

7.7.2.2 Activity Sampling - Time Studies

Further timings of direct and indirect nursing activities will be undertaken to verify the established hours of care. Five observer timings will be attended on each direct care intervention available in the Neonatal Nursing Intensity System. Six days of observation will be undertaken to test validity of the weighted factor used for indirect activities in the N.N.I.S.

7.7.2.3 Staff Survey

A questionnaire will be developed to be completed by the Nursing Unit Manager in the neonatal unit. This questionnaire will focus on the adequacy of numbers of staff members on five separate shifts. Giovanetti and Mayer (1984) made the point that professional judgement is a valuable and necessary component of the patient classification process, and should not be overlooked in the process of validity monitoring. Despite the subjective aspects involved, the judgement of professional nurses has been found to reflect the actual unit situation.

7.7.3 Reliability

Reliability testing will take the form of interrater reliability testing. For the interrater reliability testing, a nurse expert in the field will be requested to participate. Twenty percent of the unit census (or five neonates, whichever is the greater) will provide an adequate sample size for testing. Testing reliability will occur on different days of the week, and on shifts which are not consecutive. Interrater reliability testing will be attended shortly after the nurses have completed the Neonatal Nursing Intensity Tool, at which time the expert nurse

will assess the neonate's needs and complete the N.N.I.T. Random sampling will assure that neonates in all care categories are compared. Staff will not be notified prior to monitoring commencing.

A percentage of agreement between expert and clinical nurse will be used to measure reliability. A high level of agreement between selection of individual indicators will be sought, the reason for differences in rating will be discovered and corrective action taken. Ninety percent or more agreement will be accepted. Eighty to ninety percent agreement will indicate the need for discussion with the individual clinical nurse. Agreement below 80% will indicate the need for further education or a review of the criteria for use of the N.N.I.T., or both.

7.7.4 Summary

Processes for validation of the Neonatal Nursing Intensity System have been outlined. Methods for testing validity and reliability have been discussed. Validation testing is consistent with the recommendations of Giovanetti (1979) and Giovanetti and Mayer (1984).

7.8 Summary

The development of the Neonatal Nursing Intensity System for use with staff scheduling has been shown. The (N.N.I.S.) is a factor evaluation patient classification system which will require further validity and reliability testing before being used with confidence in staff scheduling. Methods of validity and reliability testing have been discussed.

CHAPTER EIGHT

CONCLUSIONS AND RECOMMENDATIONS

CHAPTER 8: CONCLUSIONS AND RECOMMENDATIONS

8.1 Introduction

In this final chapter a brief review of the aims and objectives in relation to the findings is presented.

The following caution needs to be exercised with regard to generalisation of the findings and the developed tool:

The study was conducted in two hospitals only, therefore adaptation of the Neonatal Nursing Intensity System to any other environment would require establishments of timings within those areas.

From the findings reported for the study the investigator has been led to conclude that the aim and objectives of the study have been achieved.

8.1.1 Direct care nursing activities within the neonatal unit have been observed and timed. Statistical analysis has been applied to determine average time standards for direct care nursing interventions.

8.1.2 Indirect care nursing activities within the neonatal unit have been observed and timed. Statistical analysis has been applied to determine average time standards for indirect care nursing interventions.

8.1.3 Data collected by observation technique has been validated by expert neonatal nurses.

8.1.4 A patient classification system which may be used in staff scheduling within a neonatal unit has been developed.

8.2 Investigations

8.2.1 Direct Care Nursing Activities

The findings concerning direct care nursing interventions showed that direct care nursing activities within the neonatal unit were generally tailored specifically to the individual's need. It has been shown that there are many variables, including unit policy, severity of illness and physician request which influence nursing practice and therefore nursing workload. Extensive quantitative data collection and statistical analysis has determined mean standard times for forty three direct care nursing interventions.

8.2.2 Indirect Care Nursing Activities

The findings concerning indirect care nursing activities indicated that these activities were clinically orientated and governed by nursing policy and support systems available. Extensive quantitative data collection and statistical analysis has determined average times for indirect nursing activities for the three shifts in a twenty four hour period.

8.3 Conclusions and Recommendations

The study which has been reported here has focussed on the development of The Neonatal Nursing Intensity System, a simple factor evaluation patient classification system for use in staff scheduling within neonatal units. The study has highlighted the complex problem of measuring nursing workload and staff utilisation within a neonatal unit.

8.3.1 The study should be replicated in a different practice setting in order to test the findings which have emerged from the study and how they might apply to other neonatal units.

8.3.2 Replication would also need to be carried out to support the reliability and validity of this study.

8.3.3 Further detailed research is required into nursing workload in neonatal units to provide data which can be used for diagnostic related groups or case mix data.

Finally this study has resulted in a patient classification system formulated from quantitative research methods and validated by expert nurses. A reliable and valid instrument has been developed to measure nursing workload and predict nursing resource utilisation within a neonatal unit.

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GLOSSARY

Apnoea	Absence of respirations for greater than fifteen seconds.
Blood gas	Sample of arterial blood analysed for oxygen, carbon dioxide levels and pH.
Bradycardia	Heart rate less than 120 beats per minute.
C.N.S.	Clinical Nurse Specialist.
Cardio-respiratory monitoring	Electronic monitoring to provide continuous observation of heart and respiratory rate.
Central venous line	A catheter inserted in a large blood vessel, the tip resting in the atrium of the heart. Used for parenteral fluid therapy.
Clinical Nurse Specialist	A nurse considered an expert in her\his chosen field. Generally has undertaken specialised education in that field.
Criteria	Plural of criterion. A set of criteria or variables form the basis of patient classification systems and of quality assurance audits. The criteria provide the means of measuring a predetermined set of standards of care.
Criterion	A predetermined indicator, characteristic, variable or attribute use to measure the patient's dependency on nursing care or that quality of care.
Direct Care	The time spent by the nurse in providing bedside or "hands on" nursing care.
Endotracheal tube	A tube sited in the trachea to enable mechanical ventilation.

Extubation	Removal of an endotracheal tube to enable spontaneous respiration.
F.T.E.	Full time equivalent.
Feeding - gavage	Feeding through a tube inserted through the mouth and sited in the stomach.
Full time Equivalent	The number of staff required to full one position seven days per week and fifty two weeks per year. Time must be allowed for days off, annual leave and sick leave.
Gastric decompression	Venting of the stomach via a orogastric tube to reduce air distension during ventilation.
Headbox	A perspex box placed over the baby's head and used to maintain a concentration of oxygen.
Indirect Care	The time spent by the nurse in patient related activities which do not involve "hands on" care.
Intervention	A specific activity.
Intubation	Introduction of an endotracheal tube to enable mechanical ventilation.
Level 1 Nursery	Normal newborn nursery.
Level 2 Nursery	Special care nursery.
Level 3 Nursery	Intensive care nursery.
Meconium aspiration	A condition resulting from foetal distress prior to delivery resulting in respiratory distress from inhaled meconium.
N.H.P.P.D.	Nursing Hours Per Patient Day
N.I.C.U.	Neonatal Intensive Care Unit

N.U.M.	Nursing Unit Manager.
Nasopharyngeal Tube	A tube sited in the nasopharynx to enable respiratory support.
Neonatal	The period of time from birth to one month postnatal age.
Neonatal Special Care Unit	Level 2 Nursery caring for babies who are moderately sick. Babies admitted would be greater than 32 weeks gestation.
Neonatal Intensive Care Unit	Level 3 Nursery caring for critically ill neonates offering advanced technology, full ventilation support and extensive support services.
Neonatal	Pertaining to the neonate.
Neonate	A newborn infant up to the age of one month.
Neonatologist	A medical officer specifically trained to care for the sick newborn.
Non-nutritive sucking	A pacifier is offered to the neonate to enable him\her to suck and receive comfort whilst being gavage fed.
Orogastric	A tube introduced through the mouth and sited in the stomach to enable feeding or gastric decompression.
P.C.S.	Patient Classification System.
Pacifier	Also known as a "dummy".
Parenteral nutrition	A method of intravenous feeding. Fluids administered contain proteins and vitamins to enable growth rather than weight maintenance.
Patient Classification System	The means by which patients are classified into discrete groups according to their requirements for

	nursing care. The PCS is comprised of a tool for classification, a method of quantifying the patient's requirement into time required for nursing care, and a method of allocating staff according to those requirements which ideally takes into account the mix of skills required.
Patient Classification Tool	The instrument used for placing patients into various care categories, or classes, according to their requirements for nursing care.
Patient Allocation	The method by each member of the nursing team is allocated a certain number of patients and the team member then carries out all the care required for those patients.
Perinatal	Pertaining to the foetus prior to birth and the neonate up to one month of age.
Pneumonitis	An inflammatory respiratory condition resulting from meconium aspiration.
Prematurity	Relating to the neonate born before 37 completed weeks of gestation.
Preterm	Born before 37 completed weeks gestation.
R.N.	Registered Nurse.
Reliability	The consistency, accuracy and precision of the data. Also refers to the consistency in measurement between observers when scoring the same phenomena.

Reliability: Inter-rater	The consistency with which all persons using the P.C.S. classify the same patient.
Retrieval Team	A team of medical and nursing experts who will retrieve ill patients from Level 1 or Level 2 nurseries and transport them to a Level 3 Nursery.
Swaddled	A method of wrapping to restrict movement and simulate the confined position in utero. Used to settle preterm neonates.
Validity	The determination of the extent to which the instrument actually reflects the abstract construct being examined.
Ventilator	Medical equipment used to provide artificial respiration.

APPENDIX

ONE

Nursing Intervention Tool

(N.I.T.)

APPENDIX 1: Nursing Intervention Tool

NURSING INTERVENTION TOOL (N.I.T.)

Nursing Intervention:.....

Date Attended:..... Reference:..... Attended by:.....
Level of Unit:..... Level of Baby:.....

Preparation for Intervention	Commenced Completed		Time in Minutes	
Undertaking Intervention	Commenced Completed		Time in Minutes	
Post Intervention Phase	Commenced Completed		Time in Minutes	
Documentation of Intervention	Commenced Completed		Time in Minutes	
Total Intervention	Commenced Completed		Time in Minutes	
Assistant Required	Commenced Completed		Time in Minutes	

TOTAL INTERVENTION	TIME IN MINUTES	

Caring \ Supportive Actions	During Interventions	
Soothing Baby	Yes No	..... Minutes
Settling Baby	Yes No	..... Minutes
Parent Support	Yes No	..... Minutes
Parent Education	Yes No	..... Minutes
TOTAL		..... Minutes
% TOTAL INTERVENTION		

APPENDIX

TWO

Nursing Intervention Tool

(N.I.T.)

Revised

APPENDIX 2: Nursing Intervention Tool - Revised

NURSING INTERVENTION TOOL (N.I.T.)

Nursing Intervention:.....

Date Attended:..... Reference:..... Attended by:.....

Level of Unit:..... Level of Baby:.....

Undertaking Intervention	Commenced Completed		Time in Minutes	
Assistant Required	Commenced Completed		Time in Minutes	
TOTAL INTERVENTION		TIME IN MINUTES		

Activities External to Intervention	
Activities	**Minutes**

APPENDIX

THREE

Indirect Activity Tool

(I.N.D.A.T.)

APPENDIX 3: Indirect Activity Tool

INDIRECT ACTIVITY TOOL (I.N.D.A.T.)

Date Attended:..... Reference:..... Attended by:.....

Start:..... Finish:..... Hours:.....

Level of Unit:..... Code: Nursing Related = 2 Non Nursing Related = 4

Activity	Commenced	Completed	Time	Code

APPENDIX

FOUR

Expert Nurses' Assessment Tool

(E.N.A.T.)

APPENDIX 4: Expert Nurses Assessment Tool

EXPERT NURSES ASSESSMENT TOOL (E.N.A.T.)

Nursing Intervention								
Admission - Level 2								
Admission - Level 3								
Bath								
Bath - sponge								
Blood gas - arterial								
Blood gas - peripheral								
Blood glucose monitoring								
Discharge								
Extubation								
Feeding - bottle								
Feeding - gavage 1\24								
Feeding - gavage 2\24								
Feeding - gavage 3\24								
Fluid line change-arterial								
Fluid line change-central								
Fluid line change-venous								
Medications - IV bolus								
Medications - IV infusion								
Medications - oral								
General care - non ventilated								
General care - ventilated								

APPENDIX 4: Expert Nurses Assessment Tool (cont.)

EXPERT NURSES ASSESSMENT TOOL (E.N.A.T.)

Nursing Intervention								
Observations - non-ventilated								
Observations - ventilated								
Parents - education - Parentcraft								
Parents - education - Assisting with care								
Physiotherapy - chest								
Settling\Comfort Simple								
Settling\Comfort Involved								
Suction - ETT								
Suction - NPT								
Tubing change - headbox								
Tubing change - ventilator								
Ultrasound - assist								
Weigh - non-ventilated								
Weigh - ventilated								

APPENDIX

FIVE

Structured Format Used in Data Collection of Expert Nurses' Judgement of Time Taken for Nursing Interventions

APPENDIX 5: Structured Format Used for Data Collection of Expert Nurses' Judgement of Time Taken for Nursing Interventions

I would like to ask you some questions in relation to how long you would generally take to undertake certain nursing activities.

I would like you to think carefully before you answer and draw on your experience for an average time, rather than consider just the most recent couple of times you have attended these interventions.

In your answer I would like you to consider the total intervention, including preparation, documentation and disposing of any equipment used. I would like you to also consider any assistance you would require from another nurse and include that in your answer.

Do you have any questions? We will now go through the list of activities on this form, and consider each intervention individually. Please take all the time you need before giving me your answer.

APPENDIX

SIX

Validation of Timings

APPENDIX 6: Validation of Timings by the Researcher

Interventions Timed by Researcher and Independent Observer during Validation of Timings.

Intervention	Researcher Time (Minutes)	Observer Time (Minutes)	Difference
Gavage Feeding	7	7	0
Observations	3	3	0
Observations	3	3	0
Observations	2	2	0
Venous Cannulation	12	13	1
I.V. Bolus Medication	22	21	1
I.V. Bolus Medication	14	14	0
Observations	2	2	0
Observations	3	3	0
I.V. Bolus Medication	12	11	1
Arterial Blood Gases	7	7	0
TOTAL DIFFERENCE			**3**

Data was analysed using the Pearson Product Moment Correlation Coefficient.

$r = 0.997$. $p = 0.5$

APPENDIX

SEVEN

Consent Form

UNIVERSITY OF WOLLONGONG

DEPARTMENT OF NURSING

PERSONAL CONSENT

I agree to permit Heather Mann to observe my nursing activities in the Neonatal Nurseries. I understand that she is presently conducting research for a Masters thesis in the Faculty of Health and Behavioural Sciences, Nursing Department at the University of Wollongong. I understand that all information I supply will be treated in the strictest confidence.

The procedures to be used have been fully explained to me and I have had adequate opportunity to ask questions.

I agree that Heather Mann may use the results of my interview and observations, apart from those that might identify me, in any studies or publications aimed at furthering the understanding of the role and activities of neonatal nursing.

I have read and understood the foregoing and I voluntarily consent to participate.

I understand that I can withdraw my consent at any time.

Signed:.....

Date:.....

Witness:.....

Date:.....

NORTHFIELDS AVENUE, WOLLONGONG, N.S.W. 2522 AUSTRALIA
Phone: (042) 21 3555 (Switchboard), (042) 21 3767 Direct. Fax: (042) 21 3137.

APPENDIX

EIGHT

Description of Direct Care Nursing Interventions

APPENDIX 8: Description of Direct Care Interventions

1 Observation and Monitoring Activities

1.1 Observations - Ventilated Neonate

Nurses utilised monitoring equipment to attend non-touch observations of the ventilated neonate's vital signs including heart and respiratory rate, blood pressure, temperature, environmental temperature and monitoring of oxygen saturation. Ventilatory support and parenteral fluid intake were recorded.

1.2 Observations - Non Ventilated Neonate

Monitoring equipment was used to attend non-touch observations of the non-ventilated neonate's vital signs including heart and respiratory rate, blood pressure, temperature, environmental temperature and monitoring of oxygen saturation. Observations of ambient oxygen and parenteral fluid intake were noted and recorded if applicable.

1.3 Blood Glucose Monitoring

Heel prick blood sampling was undertaken to obtain a specimen for blood glucose monitoring. Collection of the specimen, use of the blood glucose monitoring equipment and documentation were included.

1.4 Blood Gas Analysis - Arterial

Blood was withdrawn from an established arterial line to obtain a specimen for blood gas analysis. Collection of the specimen, analysis using equipment within the unit and documentation were observed.

1.5 Blood Gas Analysis - Peripheral

Heel prick blood sampling was attended to obtain a specimen for blood gas analysis. Collection of the specimen, analysis using equipment within the unit and documentation was observed.

1.6 Weight Estimation - Ventilated Neonate

Nurses removed or disconnect some monitoring equipment and parenteral fluid lines. With the assistance of another registered nurse the neonate was moved from the bed to the scales and hand ventilated while weight was estimated. All disconnected or removed lines\cables were then replaced.

1.7 Weight Estimation - Non Ventilated Neonate

Monitoring equipment and parenteral fluid lines was removed and alternative ambient oxygen supply arranged if necessary. The neonate was placed on the scales and weight estimated. All disconnected or removed lines\cables were then replaced and normal ambient oxygen supply re-established.

1.8 Admission - Level 2

The neonate was received and placed within an incubator. Assessment of vital signs and weight estimation were undertaken, monitoring equipment such as cardio-respiratory monitors, oxygen saturation monitors or transcutaneous oxygen monitors were attached. Inspired oxygen was provided if required. Discussions with accompanying parents and documentation was observed.

1.9 Admission - Level 3

The neonate was placed on an open care centre. Assessment of vital signs and weight estimation were undertaken, monitoring equipment such as cardio-respiratory monitors, oxygen saturation monitors or transcutaneous oxygen

monitors were attached. Intubation and ventilation was attended if necessary. Discussions with an accompanying parent and documentation was observed.

2 Nutrition and Fluid Management Activities

2.1 Feeding - Bottle

Milk was obtained and warmed in preparation. Parenteral fluid lines and monitoring cables were reorganised and alternative ambient oxygen supply arranged if necessary. The infant was taken from the bed\incubator and held by the nurse until the feeding was complete. Lines and cables were again reorganised and normal ambient oxygen supply re-established.

2.2 Feeding - Gavage - Hourly

Milk was obtained and warmed, a gastric tube was inserted (if necessary) and position of the tube verified. The nurse held the tube during feeding by gravity and observed the infant until the feeding was complete.

2.3 Feeding - Gavage - Second or Third Hourly

A gastric tube was inserted (if necessary) and position of the tube was verified. Milk was warmed in preparation and the nurse held the tube during feeding by gravity and observed the infant until the feeding was complete.

2.4 Parenteral Fluid Line Change - Arterial

With the assistance of another registered nurse, medications were added to a flask of fluids. Fluid from this flask was then withdrawn into a syringe, an administration line was attached and primed. The primary care nurse then replaced the existing arterial line fluid and line with the newly prepared set,

resetting the infusion syringe. In some instances nurses were observed to use a flask of fluid which had been previously prepared.

2.5 Parenteral Fluid Line Change - Central

The primary care nurse attended a surgical scrub in preparation for undertaking changing parenteral fluids and lines as a sterile procedure. A registered nurse acted as assistant for the procedure. Fluid administration lines were then attached and primed. The primary care nurse then replaced existing parenteral fluids and lines with the newly prepared set and reset the infusion pump.

2.6 Parenteral Fluid Line Change - Venous

The primary nurse and a registered nurse assistant added supplements or medications to a flask of fluids. Fluid administration lines were then attached and primed. The primary care nurse then replaced existing parenteral fluids and lines with the newly prepared set and reset the infusion pump.

2.7 Cannula Insertion Assist -Arterial

The nurse assisted the medical officer during insertion of an arterial cannula. This involved holding the neonate to provide stability and comforting during the cannulation. Assisting with strapping the cannula and commencing arterial fluids was also attended.

2.8 Cannula Insertion Assist -Venous

A medical officer was assisted during the insertion of a venous cannula. The nurse held the neonate to provide stability and provided comfort during the cannulation. Assisting with strapping the cannula and commencing venous fluids was also attended.

2.9 Cannula Removal

A cannula was removed and pressure applied to the site. A dressing was applied.

2.10 Catheter Insertion Assist -Central

The medical officer was assisted during insertion of a central venous catheter. The neonate was comforted and held to provide stability during the procedure. After X-Ray to confirm position strapping the catheter and commencing fluids was attended.

2.11 Catheter Insertion Assist -Umbilical

The medical officer was assisted during insertion of an umbilical catheter. This involved holding the neonate to provide stability, and vital signs were observed. After X-Ray to confirm position the catheter was strapped and fluids commenced.

2.12 Catheter Removal

An indwelling catheter was removed and pressure applied to prevent possible blood loss. A dressing was applied.

3 Hygiene, Comfort and General Care Activities

3.1 General Care - Ventilated Neonate

The nurses assessed current status by recording per axilla temperature, auscultating heart rate, observing respiratory rate, colour and perfusion. Ventilatory support and parenteral fluid intake were recorded. The position of monitoring devices such as oxygen saturation or transcutaneous oxygen sensors were changed. Oral, eye and perineal toilets were attended and position changed.

3.2 General Care - Non Ventilated Neonate

The neonate's current status was assessed by recording per axilla temperature, auscultating heart rate, observing respiratory rate, colour and perfusion. Ambient oxygen concentration and parenteral fluid intake were recorded if applicable. Monitoring devices such as oxygen saturation or transcutaneous oxygen sensors were repositioned. Oral, eye and perineal toilets were attended and position changed.

3.3 Bath

The neonate was bathed and dressed. Monitoring equipment was removed and alternative ambient oxygen arranged if necessary prior to bathing and replaced on completion.

3.4 Bath - Sponge

The neonate was sponge bathed and dressed within the incubator or open care centre. Monitoring electrodes were removed and replaced after the sponge.

3.5 Physiotherapy - Chest

Postural drainage and chest percussion\vibration was attended prior to endotracheal toilet.

3.6 Endotracheal Tube Toilet

Endotracheal tube toilet was undertaken with the assistance of another registered nurse. Normal saline was instilled and the endotracheal tube was suctioned two or three times. Recovery phase was allowed between suctionings. The primary care nurse completed the procedure by attending oral suction.

3.7 Nasopharyngeal Tube Toilet

The primary nurse attended suction of the nasopharyngeal tube. Suction was attended two or three times and the oral cavity was also suctioned.

3.8 Environmental Hygiene - Headbox Tubing Change

The humidifier dome and oxygen supply tubing to the headbox was removed and replaced with clean equipment. Ambient oxygen concentrations were re-established.

3.9 Environmental Hygiene - Ventilator Tubing Change

The complete ventilator tubing circuit and humidifier dome was changed. A registered nurse assistant was required for part of the intervention to hand ventilate throughout the procedure.

3.10 Comfort\Settling - Involved

Nurses were observed to spend time comforting and settling the neonates by cuddling, relaxation massages or relaxation bathing.

3.11 Comfort\Settling - Simple

Nurses comforted and attempted to settle neonates by stroking and gentle speech.

4 Therapeutic and Diagnostic Activities

4.1 Medication Administration - Intravenous Bolus

The primary nurse, with the assistance of another registered nurse, undertook preparation, administration and documentation of bolus intravenous medications. The primary nurse used an existing intravenous cannula.

4.2 Medication Administration - Intravenous Infusion

With the assistance of another registered nurse, preparation, commencement and documentation of one intravenous infusion medication was attended. The prepared medication was attached to a fluid administration line and the attached line was primed. The primary care giving nurse connected the medications via an existing intravenous cannula and reset the infusion pump.

4.3 Medication Administration - Oral

Oral medications were prepared with the assistance of another registered nurse, and administered via a teat or gastric tube by the primary care nurse.

4.4 Dressings

Nurses attended a variety of dressings, including colostomy dressings and surgical wound dressings.

4.5 Extubation

With the assistance of a second registered nurse, an endotracheal or nasopharyngeal tube was removed and provision of ambient oxygen by a headbox was attended. Repositioning was attended.

4.6 Intubation - Assist

A medical officer was assisted to insert an endotracheal or nasopharyngeal tube to allow ventilation support. The primary care nurse and an assistant nurse were required for stabilisation and fixation of the endotracheal tube during intubation. Ventilation was commenced.

4.7 Ultrasound - Assist

A radiographer was assisted to undertake a diagnostic ultrasound. This involved maintaining appropriate position of the neonate to ensure effective ventilation (if necessary) and quality of the ultrasound.

4.8 X-Ray - Assist

The nurse assisted a radiographer to attend an X-Ray. Position of the neonate was maintained throughout the procedure to ensure effective ventilation, if necessary, and quality of the X-Ray.

5 Parent Education

5.1 Parentcraft Education

Parents were offered education related to a number of parentcraft activities. These included bathing demonstrations, education on management of oxygen therapy and feeding.

5.2 Parent Education - Assisting with Care

Nurses attended education for parents in a variety of activities to assist with care. These included attending eye, umbilical and oral toilets, and nappy change.

5.3 Discharge

Nurses spent time with the parents discussing aspects of care and parentcraft. Documentation in case notes was observed. Variability in the time taken for this procedure was dependent upon the complexity of parentcraft demonstrations and the receptiveness of the parents.

APPENDIX

NINE

Observer Timed Direct Care

Data Related to

Observations and Monitoring Activities

APPENDIX 9: DIRECT CARE INTERVENTIONS – OBSERVATION AND MONITORING

OBSERVATIONS – VENTILATED INFANT						OBSERVATIONS – NON VENTILATED INFANT					BLOOD GAS – ARTERIAL				
	Primary Nurse	Activities External to Intervention	Corrected Primary Nurse	Assistant Nurse	Total	Primary Nurse	Activities External to Intervention	Corrected Primary Nurse	Assistant Nurse	Total	Primary Nurse	Activities External to Intervention	Corrected Primary Nurse	Assistant Nurse	Total
	2		2		2	1		1		1	5		5		5
	3	1	2		2	1		1		1	5		5		5
	2		2		2	1		1		1	6		6		6
	2		2		2	1		1		1	6		6		6
	4	2	2		2	2		2		2	6		6		6
	2		2		2	2		2		2	7		7		7
	3	1	2		2	2		2		2	7		7		7
	2		2		2	2		2		2	7		7		7
	3		3		3	2		2		2	7		7		7
	3		3		3	2		2		2	7		7		7
	3		3		3	2		2		2	7		7		7
	3		3		3	2		2		2	8		8		8
	3		3		3	2		2		2	8		8		8
	3		3		3	2		2		2	8		8		8
	3		3		3	2		2		2	8		8		8
	3		3		3	2		2		2	9		9		9
N	16	3	16	0	16	16	0	16	0	16	16	0	16	0	16
Mean	2.75	1.33	2.50		2.50	1.75		1.75		1.75	6.94		6.94		6.94
Maximum	4	2	3		3	2		2		2	9		9		9
Minimum	2	1	2		2	1		1		1	5		5		5
Standard Deviation	0.56	0.47	0.50		0.50	0.43		0.43		0.43	1.09		1.09		1.09
Coefficient of Variation	20.33%	35.36%	20.00%		20.00%	24.74%		24.74%		24.74%	15.68%		15.68%		15.68%
% of Total			100.00%	0.00%	100.00%			100.00%	0.00%	100.00%			100.00%	0.00%	100.00%

BLOOD GAS – PERIPHERAL						BLOOD GLUCOSE MONITORING						WEIGHT ESTIMATION – VENTILATED NEONATE					
	Primary Nurse	Activities External to Intervention	Corrected Primary Nurse	Assistant Nurse	Total	Primary Nurse	Activities External to Intervention	Corrected Primary Nurse	Assistant Nurse	Total		Primary Nurse	Activities External to Intervention	Corrected Primary Nurse	Assistant Nurse	Total	
	6		6		6	3		3		3		7		7	3	10	
	6		6		6	3		3		3		8	1	7	3	10	
	7		7		7	3		3		3		7		7	3	10	
	7		7		7	3		3		3		7		7	3	10	
	7		7		7	4		4		4		7		7	3	10	
	7		7		7	4		4		4		8	1	7	3	10	
	7		7		7	4		4		4		7		7	3	10	
	7		7		7	4		4		4		8		8	3	11	
	7		7		7	4		4		4		8		8	3	11	
	7		7		7	4		4		4		8		8	3	11	
	8		8		8	4		4		4		8		8	3	11	
	8		8		8	4		4		4		8		8	3	11	
	8		8		8	5		5		5		8		8	3	11	
	8		8		8	5		5		5		8		8	3	11	
	8		8		8	5		5		5		8		8	3	11	
	8		8		8	5		5		5							
N	16	0	16	0	16	16	0	16	0	16		15	2	15	15	15	
Mean	7.25		7.25		7.25	4.00		4.00		4.00		7.67	1.00	7.53	3.00	10.53	
Maximum	8		8		8	5		5		5		8	1	8	3	11	
Minimum	6		6		6	3		3		3		7	1	7	3	10	
Standard Deviation	0.66		0.66		0.66	0.71		0.71		0.71		0.47	0.00	0.50	0.00	0.50	
Coefficient of Variation	9.12%		9.12%		9.12%	17.68%		17.68%		17.68%		6.15%	0.00%	6.62%	0.00%	4.74%	
% of Total			100.00%	0.00%	100.00%			100.00%	0.00%	100.00%				71.52%	28.48%	100.00%	

APPENDIX 9: DIRECT CARE INTERVENTIONS – OBSERVATION AND MONITORING

WEIGHT ESTIMATION – NON VENTILATED NEONATE						ADMISSION – LEVEL 2						ADMISSION – LEVEL 3				
	Primary Nurse	Activities External to Intervention	Corrected Primary Nurse	Assistant Nurse	Total	Primary Nurse	Activities External to Intervention	Corrected Primary Nurse	Assistant Nurse	Total	Primary Nurse	Activities External to Intervention	Corrected Primary Nurse	Assistant Nurse	Total
	7		7		7	19		19		19	32		32		32
	7		7		7	22	2	20		20	35		35		35
	7		7		7	23		23		23	40		40		40
	8		8		8	30		30		30	40		40		40
	8		8		8	30		30		30	50		50		50
	8		8		8	33		33		33	52		52		52
	8		8		8	35		35		35	60		60		60
	8		8		8	35		35		35	60		60		60
	8		8		8	40		40		40	60		60		60
	8		8		8	40		40		40	61		61		61
	9		9		9	40		40		40	62		62		62
	9		9		9	40		40		40	62		62		62
	9		9		9	45		45		45	65		65		65
	9		9		9	45		45		45	65		65		65
	9		9		9						65		65		65
N	15	0	15	0	15	14	1	14	0	14	15	0	15	0	15
Mean	8.13		8.13		8.13	34.07	2.00	33.93		33.93	53.93		53.93		53.93
Maximum	9		9		9	45	2	45		45	65		65		65
Minimum	7		7		7	19	2	19		19	32		32		32
Standard Deviation	0.72		0.72		0.72	8.07	0.00	8.29		8.29	11.27		11.27		11.27
Coefficient of Variation	8.83%		8.83%		8.83%	23.67%	0.00%	24.44%		24.44%	20.89%		20.89%		20.89%
% of Total			100.00%	0.00%	100.00%			100.00%	0.00%	100.00%			100.00%	0.00%	100.00%

APPENDIX

TEN

Observer Timed Direct Care Data Related to Nutrition and Fluid Management Activities

FEEDING – BOTTLE						FEEDING – GAVAGE – HOURLY					FEEDING – GAVAGE – 2/24 OR 3/24				
	Primary Nurse	Activities External to Intervention	Corrected Primary Nurse	Assistant Nurse	Total	Primary Nurse	Activities External to Intervention	Corrected Primary Nurse	Assistant Nurse	Total	Primary Nurse	Activities External to Intervention	Corrected Primary Nurse	Assistant Nurse	Total
	15	3	12		12	6		6		6	10		10		10
	15		15		15	8	2	6		6	10		10		10
	15		15		15	6		6		6	14	3	11		11
	22		22		22	10	4	6		6	12		12		12
	25		25		25	6		6		6	15		15		15
	27		27		27	7		7		7	15		15		15
	30		30		30	8		8		8	15		15		15
	30		30		30	10	2	8		8	16		16		16
	30		30		30	9		9		9	18	1	17		17
	30		30		30	9		9		9	17		17		17
	30		30		30	9		9		9	17		17		17
	30		30		30	9		9		9	18		18		18
	32		32		32	11	1	10		10	18		18		18
	35		35		35	10		10		10	19		19		19
	36		36		36	11	1	10		10	20		20		20
	42		42		42	10		10		10	20		20		20
											22		22		22
N	16	1	16	0	16	16	5	16	0	16	17	2	17	0	17
Mean	27.75	3.00	27.56		27.56	8.69	2.00	8.06		8.06	16.24	2.00	16.00		16.00
Maximum	42	3	42		42	11	4	10		10	22	3	22		22
Minimum	15	3	12		12	6	1	6		6	10	1	10		10
Standard Deviation	7.50	0.00	7.85		7.85	1.65	1.10	1.60		1.60	3.30	1.00	3.46		3.46
Coefficient of Variation	27.04%	0.00%	28.48%		28.48%	18.97%	54.77%	19.84%		19.84%	20.32%	50.00%	21.65%		21.65%
% of Total			100.00%	0.00%	100.00%			100.00%	0.00%	100.00%			100.00%	0.00%	100.00%

FLUID LINE CHANGE – ARTERIAL						FLUID LINE CHANGE – CENTRAL						FLUID LINE CHANGE – VENOUS					
	Primary Nurse	Activities External to Intervention	Corrected Primary Nurse	Assistant Nurse	Total	Primary Nurse	Activities External to Intervention	Corrected Primary Nurse	Assistant Nurse	Total	Primary Nurse	Activities External to Intervention	Corrected Primary Nurse	Assistant Nurse	Total
	7	2	5	2	7	19		19	6	25	11		11	4	15
	9	3	6	2	8	18		18	8	26	11		11	4	15
	7		7	2	9	19		19	13	32	12		12	3	15
	7		7	2	9	22		22	10	32	11		11	4	15
	8		8	2	10	25	2	23	10	33	12		12	4	16
	8		8	2	10	21		21	15	36	12		12	4	16
	8		8	2	10	23		23	15	38	13	1	12	4	16
	8		8	2	10	23		23	15	38	12		12	5	17
	12	3	9	4	13	23		23	15	38	13		13	4	17
	10		10	4	14	23		23	15	38	13		13	4	17
	10		10	4	14	29		29	18	47	13		13	4	17
	12		12	3	15	28		28	20	48	14		14	4	18
	10		10	5	15	30		30	18	48	13		13	5	18
	12		12	4	16	30		30	19	49	13		13	5	18
	12		12	5	17	29		29	20	49					
						30		30	20	50					
N	15	3	15	15	15	16	1	16	16	16	14	1	14	14	14
Mean	9.33	2.67	8.80	3.00	11.80	24.50	2.00	24.38	14.81	39.19	12.36	1.00	12.29	4.14	16.43
Maximum	12	3	12	5	17	30	2	30	20	50	14	1	14	5	18
Minimum	7	2	5	2	7	18	2	18	6	25	11	1	11	3	15
Standard Deviation	1.89	0.47	2.10	1.15	3.08	4.14	0.00	4.15	4.28	8.13	0.89	0.00	0.88	0.52	1.12
Coefficient of Variation	20.20%	17.68%	23.91%	38.49%	26.11%	16.89%	0.00%	17.03%	28.86%	20.76%	7.24%	0.00%	7.17%	12.43%	6.79%
% of Total			74.58%	25.42%	100.00%			62.20%	37.80%	100.00%			74.78%	25.22%	100.00%

APPENDIX 10: DIRECT CARE INTERVENTIONS – NUTRITION AND FLUID MANAGEMENT

	CANNULA INSERTION ASSIST – ARTERIAL					CANNULA INSERTION ASSIST – VENOUS					CATHETER INSERTION ASSIST – CENTRAL				
	Primary Nurse	Activities External to Intervention	Corrected Primary Nurse	Assistant Nurse	Total	Primary Nurse	Activities External to Intervention	Corrected Primary Nurse	Assistant Nurse	Total	Primary Nurse	Activities External to Intervention	Corrected Primary Nurse	Assistant Nurse	Total
	15	3	12		12	12	3	9		9	35	15	20		20
	15	3	12		12	12	3	9		9	43	17	26		26
	17	4	13		13	18	8	10		10	40	14	26		26
	23	10	13		13	17	7	10		10	42	15	27		27
	23	8	15		15	22	11	11		11	45	17	28		28
	29	14	15		15	20	9	11		11	49	19	30		30
	32	14	18		18	15	4	11		11	55	20	35		35
	36	17	19		19	22	10	12		12	62	23	39		39
	39	20	19		19	17	5	12		12	68	23	45		45
	51	27	24		24	30	14	16		16	70	25	45		45
	56	30	26		26	23	5	18		18					
						44	25	19		19					
						38	17	21		21					
N	11	11	11	0	11	13	13	13	0	13	10	10	10	0	10
Mean	30.55		16.91		16.91	22.31	9.31	13.00		13.00	50.90	18.80	32.10		32.10
Maximum	56		26		26	44	25	21		21	70	25	45		45
Minimum	15		12		12	12	3	9		9	35	14	20		20
Standard Deviation	13.32		4.56		4.56	9.29	6.09	3.90		3.90	11.61	3.66	8.10		8.10
Coefficient of Variation	43.62%		26.98%		26.98%	41.66%	65.47%	30.02%		30.02%	22.82%	19.44%	25.25%		25.25%
% of Total			100.00%	0.00%	100.00%			100.00%	0.00%	100.00%			100.00%	0.00%	100.00%

APPENDIX 10: DIRECT CARE INTERVENTIONS – NUTRITION AND FLUID MANAGEMENT

CATHETER INSERTION ASSIST – UMBILICAL						CANNULA REMOVE						CATHETER REMOVAL					
	Primary Nurse	Activities External to Intervention	Corrected Primary Nurse	Assistant Nurse	Total	Primary Nurse	Activities External to Intervention	Corrected Primary Nurse	Assistant Nurse	Total		Primary Nurse	Activities External to Intervention	Corrected Primary Nurse	Assistant Nurse	Total
	33	15	18		18	2		2		2		20	15	5		5
	38	16	22		22	2		2		2		19	14	5		5
	40	17	23		23	2		2		2		15	10	5		5
	40	15	25		25	2		2		2		18	13	5		5
	46	20	26		26	3		3		3		20	15	5		5
	42	14	28		28	3		3		3		21	15	6		6
	45	16	29		29	3		3		3		22	16	6		6
	55	25	30		30	3		3		3		21	14	7		7
	45	15	30		30	3		3		3		19	12	7		7
	82	35	47		47	4		4		4		17	10	7		7
N	10	10	10	0	10	10	0	10	0	10		10	10	10	0	10
Mean	46.60	18.80	27.80		27.80	2.70		2.70		2.70		19.20	13.40	5.80		5.80
Maximum	82	35	47		47	4		4		4		22	16	7		7
Minimum	33	14	18		18	2		2		2		15	10	5		5
Standard Deviation	13.02	6.23	7.37		7.37	0.64		0.64		0.64		1.99	2.01	0.87		0.87
Coefficient of Variation	27.95%	33.12%	26.52%		26.52%	23.72%		23.72%		23.72%		10.36%	15.00%	15.03%		15.03%
% of Total			100.00%	0.00%	100.00%			100.00%	0.00%	100.00%				100.00%	0.00%	100.00%

APPENDIX

ELEVEN

Observer Timed Direct Care Data Related to Hygiene, Comfort and General Care Activities

BATHING						SPONGE BATHING						ENDOTRACHEAL TUBE TOILET					
	Primary Nurse	Activities External to Intervention	Corrected Primary Nurse	Assistant Nurse	Total	Primary Nurse	Activities External to Intervention	Corrected Primary Nurse	Assistant Nurse	Total		Primary Nurse	Activities External to Intervention	Corrected Primary Nurse	Assistant Nurse	Total	
	19		19		19	11		11		11		3		3	2	5	
	20		20		20	15		15		15		4		4	2	6	
	20		20		20	15		15		15		4		4	2	6	
	20		20		20	15		15		15		4		4	2	6	
	20		20		20	15		15		15		4		4	2	6	
	21		21		21	15		15		15		4		4	2	6	
	21		21		21	15		15		15		4		4	2	6	
	21		21		21	15		15		15		4		4	2	6	
	22		22		22	15		15		15		4		4	2	6	
	22		22		22	16		16		16		4		4	2	6	
	22		22		22	16		16		16		4		4	2	6	
	22		22		22	16		16		16		4		4	2	6	
	23		23		23	16		16		16		4		4	2	6	
	23		23		23	16		16		16		4		4	2	6	
	23		23		23	16		16		16		4		4	2	6	
	24		24		24	17		17		17		5		5	3	8	
N	16	0	16	0	16	16	0	16	0	16		16	0	16	16	16	
Mean	21.44		21.44		21.44	15.25		15.25		15.25		4.00		4.00	2.06	6.06	
Maximum	24		24		24	17		17		17		5		5	3	8	
Minimum	19		19		19	11		11		11		3		3	2	5	
Standard Deviation	1.37		1.37		1.37	1.25		1.25		1.25		0.35		0.35	0.24	0.56	
Coefficient of Variation	6.38%		6.38%		6.38%	8.20%		8.20%		8.20%		8.84%		8.84%	11.74%	9.16%	
% of Total			100.00%	0.00%	100.00%			100.00%	0.00%	100.00%				65.98%	34.02%	100.00%	

NASOPHARYNGEAL TUBE TOILET						COMFORT\SETTLING – SIMPLE						COMFORT\SETTLING – INVOLVED				
	Primary Nurse	Activities External to Intervention	Corrected Primary Nurse	Assistant Nurse	Total	Primary Nurse	Activities External to Intervention	Corrected Primary Nurse	Assistant Nurse	Total	Primary Nurse	Activities External to Intervention	Corrected Primary Nurse	Assistant Nurse	Total
	3		3		3	6		6		6	8		8		8
	3		3		3	7		7		7	9		9		9
	3		3		3	7		7		7	10		10		10
	3		3		3	7		7		7	10		10		10
	3		3		3	7		7		7	14		14		14
	3		3		3	7		7		7	14		14		14
	3		3		3	7		7		7	15		15		15
	4		4		4	8		8		8	15		15		15
	4		4		4	8		8		8	16		16		16
	4		4		4	8		8		8	18		18		18
	4		4		4	8		8		8	20		20		20
	4		4		4	8		8		8	20		20		20
	4		4		4	8		8		8	35		35		35
	4		4		4	9		9		9	35		35		35
	4		4		4	9		9		9	35		35		35
						9		9		9	40		40		40
						9		9		9					
N	15	0	15	0	15	17	0	17	0	17	16	0	16	0	16
Mean	3.53		3.53		3.53	7.76		7.76		7.76	19.63		19.63		19.63
Maximum	4		4		4	9		9		9	40		40		40
Minimum	3		3		3	6		6		6	8		8		8
Standard Deviation	0.50		0.50		0.50	0.88		0.88		0.88	10.25		10.25		10.25
Coefficient of Variation	14.12%		14.12%		14.12%	11.29%		11.29%		11.29%	52.21%		52.21%		52.21%
% of Total			100.00%	0.00%	100.00%			100.00%	0.00%	100.00%			100.00%	0.00%	100.00%

ENVIRONMENTAL HYGIENE – HEADBOX TUBING CHANGE						ENVIRONMENTAL HYGIENE: VENTILATOR TUBING CHANGE					GENERAL CARE: VENTILATED NEONATE				
	Primary Nurse	Activities External to Intervention	Corrected Primary Nurse	Assistant Nurse	Total	Primary Nurse	Activities External to Intervention	Corrected Primary Nurse	Assistant Nurse	Total	Primary Nurse	Activities External to Intervention	Corrected Primary Nurse	Assistant Nurse	Total
	8		8		8	5		5	3	8	17	4	13		13
	9		9		9	6		6	3	9	13		13		13
	10		10		10	6		6	3	9	13		13		13
	10		10		10	6		6	3	9	13		13		13
	10		10		10	7		7	4	11	14		14		14
	10		10		10	7		7	4	11	14		14		14
	10		10		10	7		7	4	11	18	4	14		14
	10		10		10	7		7	4	11	14		14		14
	10		10		10	7		7	4	11	14		14		14
	10		10		10	7		7	4	11	14		14		14
	10		10		10	7		7	4	11	14		14		14
	11		11		11	7		7	4	11	14		14		14
	11		11		11	7		7	4	11	14		14		14
	11		11		11	7		7	4	11	14		14		14
	11		11		11	7		7	4	11	14		14		14
						7		7	4	11	15		15		15
											15		15		15
											15		15		15
N	15	0	15	0	15	16	0	16	16	16	18	2	18	0	18
Mean	10.07		10.07		10.07	6.69		6.69	3.75	10.44	14.39	4.00	13.94		13.94
Maximum	11		11		11	7		7	4	11	18	4	15		15
Minimum	8		8		8	5		5	3	8	13	4	13		13
Standard Deviation	0.77		0.77		0.77	0.58		0.58	0.43	1.00	1.25	0.00	0.62		0.62
Coefficient of Variation	7.67%		7.67%		7.67%	8.72%		8.72%	11.55%	9.56%	8.71%	0.00%	4.45%		4.45%
% of Total			100.00%	0.00%	100.00%			64.00%	36.00%	100.00%			100.00%	0.00%	100.00%

GENERAL CARE: NON VENTILATED NEONATE						PHYSIOTHERAPY – CHEST				
	Primary Nurse	Activities External to Intervention	Corrected Primary Nurse	Assistant Nurse	Total	Primary Nurse	Activities External to Intervention	Corrected Primary Nurse	Assistant Nurse	Total
	11		11		11	2		2		2
	12		12		12	3		3		3
	12		12		12	3		3		3
	12		12		12	3		3		3
	13		13		13	3		3		3
	15	2	13		13	3		3		3
	13		13		13	3		3		3
	13		13		13	3		3		3
	15	2	13		13	3		3		3
	14	1	13		13	3		3		3
	16	3	13		13	3		3		3
	13		13		13	3		3		3
	14		14		14	3		3		3
	14		14		14	3		3		3
	14		14		14	4		4		4
	14		14		14					
	14		14		14					
	14		14		14					
N	18	4	18	0	18	15	0	15	0	15
Mean	13.50	2.00	13.06		13.06	3.00		3.00		3.00
Maximum	16	3	14		14	4		4		4
Minimum	11	1	11		11	2		2		2
Standard Deviation	1.21	0.71	0.85		0.85	0.37		0.37		0.37
Coefficient of Variation	8.99%	35.36%	6.50%		6.50%	12.17%		12.17%		12.17%
% of Total			100.00%	0.00%	100.00%			100.00%	0.00%	100.00%

APPENDIX

TWELVE

Observer Timed Direct Care Data Related to Therapeutic and Diagnostic Activities

MEDICATIONS – INTRAVENOUS BOLUS						MEDICATIONS – INTRAVENOUS INFUSION						MEDICATIONS – ORAL				
	Primary Nurse	Activities External to Intervention	Corrected Primary Nurse	Assistant Nurse	Total	Primary Nurse	Activities External to Intervention	Corrected Primary Nurse	Assistant Nurse	Total		Primary Nurse	Activities External to Intervention	Corrected Primary Nurse	Assistant Nurse	Total
	12	4	8	3	11	9	1	8	2	10		1		1	1	2
	10	2	8	3	11	8		8	2	10		2	1	1	1	2
	10		10	3	13	8		8	2	10		2		2	1	3
	12	2	10	3	13	9		9	2	11		2		2	1	3
	22	12	10	3	13	10	1	9	2	11		1		1	1	2
	10		10	3	13	9		9	2	11		1		1	1	2
	18	9	9	4	13	9		9	2	11		1		1	1	2
	10		10	3	13	9		9	2	11		1		1	1	2
	15	6	9	4	13	9		9	2	11		1		1	1	2
	10		10	3	13	10		10	2	12		1		1	1	2
	16	7	9	4	13	10		10	2	12		2		2	1	3
	12	2	10	4	14	9		9	2	11		2		2	1	3
	18	7	11	3	14	10		10	2	12		2		2	1	3
	18	7	11	4	15	19	9	10	2	12		2		2	1	3
	22	10	12	3	15	10		10	2	12		2	1	1	1	2
	22	9	13	4	17	10		10	3	13		2		2	1	3
						10		10	3	13						
N	16	12	16	16	16	17	3	17	17	17		16	2	16	16	16
Mean	14.81	6.42	10.00	3.38	13.38	9.88	3.67	9.24	2.12	11.35		1.56	1.00	1.44	1.00	2.44
Maximum	22	12	13	4	17	19	9	10	3	13		2	1	2	1	3
Minimum	10	2	8	3	11	8	1	8	2	10		1	1	1	1	2
Standard Deviation	4.52	3.20	1.27	0.48	1.41	2.37	3.77	0.73	0.32	0.90		0.50	0.00	0.50	0.00	0.50
Coefficient of Variation	30.49%	49.88%	12.75%	14.34%	10.53%	24.02%	102.85%	7.90%	15.21%	7.96%		31.75%	0.00%	34.51%	0.00%	20.35%
% of Total			74.88%	25.12%	100.00%			81.42%	18.58%	100.00%				59.46%	40.54%	100.00%

DRESSINGS						INTUBATION – ASSIST					EXTUBATION				
	Primary Nurse	Activities External to Intervention	Corrected Primary Nurse	Assistant Nurse	Total	Primary Nurse	Activities External to Intervention	Corrected Primary Nurse	Assistant Nurse	Total	Primary Nurse	Activities External to Intervention	Corrected Primary Nurse	Assistant Nurse	Total
	12		12		12	15		15	6	21	16		16	2	18
	12		12		12	15		15	6	21	15		15	4	19
	13		13		13	15	3	12	10	22	16		16	3	19
	13		13		13	15		15	10	25	16		16	4	20
	12		12	2	14	16		16	10	26	16		16	4	20
	14		14		14	20		20	7	27	15		15	5	20
	16	1	15		15	20		20	8	28	17		17	4	21
	15		15		15	19		19	10	29	16		16	5	21
	16		16		16	21		21	8	29	16		16	5	21
	16		16		16	22		22	8	30	17		17	4	21
											17		17	4	21
											17		17	5	22
											17		17	5	22
											17		17	5	22
											17		17	5	22
N	10	1	10	1	10	10	1	10	10	10	14	0	14	14	14
Mean	13.90	1.00	13.80	2.00	14.00	17.8	3	17.5	8.3	25.8	16.29		16.29	4.21	20.50
Maximum	16	1	16	2	16	22	3	22	10	30	17		17	5	22
Minimum	12	1	12	2	12	15	3	12	6	21	15		15	2	18
Standard Deviation	1.64	0.00	1.54	0.00	1.41	2.71	0.00	3.14	1.55	3.25	0.70		0.70	0.86	1.18
Coefficient of Variation	11.80%	0.00%	11.13%	0.00%	10.10%	15.24%	0.00%	17.93%	18.70%	12.60%	4.30%		4.30%	20.41%	5.76%
% of Total			98.57%	1.43%	100.00%			67.83%	32.17%	100.00%			79.29%	20.71%	100.00%

	X-RAY – ASSIST					ULTRASOUND – ASSIST				
	Primary Nurse	Activities External to Intervention	Corrected Primary Nurse	Assistant Nurse	Total	Primary Nurse	Activities External to Intervention	Corrected Primary Nurse	Assistant Nurse	Total
	5		5		5	18	11	7		7
	5		5		5	15	7	8		8
	7		7		7	15	7	8		8
	7		7		7	25	15	10		10
	8		8		8	10		10		10
	8		8		8	20	10	10		10
	9		9		9	11		11		11
	9		9		9	17	6	11		11
	9		9		9	22	9	13		13
	9		9		9	25	12	13		13
	10		10		10					
	10		10		10					
	11		11		11					
N	13	0	13	0	13	10	8	10	0	10
Mean	8.23		8.23		8.23	17.80	9.63	10.10		10.10
Maximum	11		11		11	25	15	13		13
Minimum	5		5		5	10	6	7		7
Standard Deviation	1.76		1.76		1.76	5.00	2.83	1.92		1.92
Coefficient of Variation	21.39%		21.39%		21.39%	28.07%	29.36%	19.02%		19.02%
% of Total			100.00%	0.00%	100.00%			100.00%	0.00%	100.00%

APPENDIX

THIRTEEN

Observer Timed Direct Care Data Related to Education of Parents and Families

APPENDIX 13: DIRECT CARE INTERVENTIONS – PARENTAL EDUCATION

PARENT EDUCATION – PARENTCRAFT						PARENT EDUCATION – ASSIST WITH CARE					DISCHARGE				
	Primary Nurse	Activities External to Intervention	Corrected Primary Nurse	Assistant Nurse	Total	Primary Nurse	Activities External to Intervention	Corrected Primary Nurse	Assistant Nurse	Total	Primary Nurse	Activities External to Intervention	Corrected Primary Nurse	Assistant Nurse	Total
	7		7		7	10		10		10	40		40		40
	7		7		7	14		14		14	43		43		43
	8		8		8	17		17		17	47		47		47
	8		8		8	18		18		18	48		48		48
	9		9		9	18		18		18	50		50		50
	9		9		9	20		20		20	58		58		58
	9		9		9	20		20		20	59		59		59
	10		10		10	21		21		21	59		59		59
	10		10		10	22		22		22	60		60		60
	10		10		10	23		23		23	60		60		60
	11		11		11	27		27		27	61		61		61
	11		11		11	28		28		28	61		61		61
	12		12		12	28		28		28	61		61		61
	12		12		12	30		30		30	62		62		62
	15		15		15	30		30		30	62		62		62
	17		17		17	32		32		32	68		68		68
						32		32		32	70		70		70
N	16	0	16	0	16	17	0	17	0	17	17	0	17	0	17
Mean	10.31		10.31		10.31	22.94		22.94		22.94	57.00		57.00		57.00
Maximum	17		17		17	32		32		32	70		70		70
Minimum	7		7		7	10		10		10	40		40		40
Standard Deviation	2.64		2.64		2.64	6.35		6.35		6.35	8.15		8.15		8.15
Coefficient of Variation	25.59%		25.59%		25.59%	27.67%		27.67%		27.67%	14.30%		14.30%		14.30%
% of Total			100.00%	0.00%	100.00%			100.00%	0.00%	100.00%			100.00%	0.00%	100.00%

APPENDIX

FOURTEEN

Description of Indirect Nursing Care Activities

APPENDIX 14: Description of Indirect Care Activities

1 Oncoming Nursing Rounds

The nurse took part in nursing rounds to gain information about all patients in the unit at the beginning of the shift. Staffing allocation was also attended.

2 Handover\Reading Notes

Individual handover using case notes and bedside charts pertaining to the neonate or neonates they were to care for that shift was attended with the outgoing nurse.

3 Checking Environment and Patient Care Equipment

Monitoring and emergency equipment, such as resuscitation equipment at the bedside was checked for availability and function early in the shift.

4 Replacing Patient Care Equipment

Environmental hygiene activities such as changing suction bottles and tubing was attended.

5 Rounds with Medical Officer

The nurses took part in medical rounds with neonatologists and registrars to plan care for the next twelve hours.

6 Discussions with Parents

Discussions with the parents of each neonate in their care relating to progress and changes in treatment.

7 Documentation in Notes

Documentation of nursing reports for each neonate was attended each shift.

8 Preceptoring

Preceptoring, advising and assisting other nurses in relation to patient care activities.

9 Outgoing Nursing Round

A verbal report on the condition of the neonates they were caring for was given during the nursing round for the oncoming shift.

APPENDIX

FIFTEEN

Indirect Activities

By Activity

APPENDIX 15: INDIRECT ACTIVITIES BY ACTIVITY

ONCOMING NURSING ROUND		OUTGOING NURSING ROUND		HANDOVER READING NOTES		CHECKING ENVIRONMENT		DISCUSSIONS WITH PARENTS		PRECEPTORING	
Time	Percent of Shift	Time	Percent of Shift	Time	Percent of Shift	Time	Percent of Shift	Time	Percent of Shift	Time	Percent of Shift
								17	3.54%		
30	6.25%	3	0.63%	5	1.04%	2	0.42%	8	1.67%	7	1.46%
30	6.25%	2	0.42%	9	1.88%	3	0.63%	4	0.83%	5	1.04%
32	6.67%	2	0.42%	8	1.67%	6	1.25%	8	1.67%	7	1.46%
27	5.63%	2	0.42%	8	1.67%	6	1.25%	19	3.96%	10	2.08%
29	6.04%	2	0.42%	7	1.46%	3	0.63%	4	0.83%	5	1.04%
30	6.25%	6	1.25%	15	3.13%	2	0.42%	14	2.92%	5	1.04%
31	6.46%	5	1.04%	15	3.13%	5	1.04%	12	2.50%	5	1.04%
30	6.25%	2	0.42%	5	1.04%	4	0.83%	9	1.88%	13	2.71%
35	7.29%	3	0.63%	5	1.04%	4	0.83%	9	1.88%	9	1.88%
33	6.88%	5	1.04%	12	2.50%	3	0.63%	10	2.08%		
31	6.46%	3	0.63%	7	1.46%	3	0.63%	4	0.83%		
32	6.67%	5	1.04%	8	1.67%	5	1.04%	7	1.46%		
								9	1.88%		
								20	4.17%		
								10	2.08%		
								5	1.04%		
								5	1.04%		
								5	1.04%		
								5	1.04%		
								15	3.13%		
								3	0.63%		
								3	0.63%		
								4	0.83%		
								5	1.04%		

	Time	Percent of Shift	Time	Percent of Shift	Time	Percent of Shift	Time	Percent of Shift	Time	Percent of Shift	Time	Percent of Shift
N.	12		12		12		12		25		9	
Total	370		40		104		46		214		66	
Mean	30.83	6.42%	3.33	0.69%	8.67	1.81%	3.83	0.80%	8.56	1.78%	7.33	1.53%
Max	35	7.29%	6	1.25%	15	3.13%	6	1.25%	20	4.17%	13	2.71%
Min	27	5.63%	2	0.42%	5	1.04%	2	0.42%	3	0.63%	5	1.04%
STD	1.95	0.41%	1.43	0.30%	3.40	0.71%	1.34	0.28%	4.94	1.03%	2.67	0.56%

Max = Maximum, Min = Minimum, Std = Standard Deviation

APPENDIX 15: INDIRECT ACTIVITIES BY ACTIVITY

MEDICAL ROUNDS		REPLACING EQUIPMENT		DOCUMENTATION		NURSE'S TEA BREAKS		NURSE'S PERSONAL TIME	
Time	Percent of Shift	Time	Percent of Shift	Time	Percent of Shift	Time	Percent of Shift	Time	Percent of Shift
6	1.25%	3	0.63%	5	1.04%	20	4.17%	5	1.04%
6	1.25%	3	0.63%	15	3.13%	20	4.17%	6	1.25%
14	2.92%	2	0.42%	18	3.75%	20	4.17%	7	1.46%
5	1.04%	3	0.63%	13	2.71%	20	4.17%	6	1.25%
5	1.04%	5	1.04%	13	2.71%	20	4.17%	6	1.25%
7	1.46%	8	1.67%	11	2.29%	20	4.17%	6	1.25%
7	1.46%	6	1.25%	11	2.29%	25	5.21%	6	1.25%
10	2.08%			8	1.67%	15	3.13%	7	1.46%
10	2.08%			10	2.08%	15	3.13%	7	1.46%
6	1.25%			12	2.50%	20	4.17%	7	1.46%
				7	1.46%	20	4.17%	7	1.46%
				8	1.67%	20	4.17%	7	1.46%
						20	4.17%	7	1.46%
						20	4.17%	7	1.46%
						20	4.17%	7	1.46%
						25	5.21%	7	1.46%
						25	5.21%	5	1.04%
								5	1.04%
								5	1.04%
								6	1.25%
								6	1.25%
								6	1.25%
								7	1.46%
								7	1.46%

	Time	Percent of Shift	Time	Percent of Shift	Time	Percent of Shift	Time	Percent of Shift	Time	Percent of Shift
N.	10		7		12		17		24	
Total	76		30		131		345		152	
Mean	7.60	1.58%	4.29	0.89%	10.92	2.27%	20.29	4.23%	6.33	1.32%
Max	14	2.92%	8	1.67%	18	3.75%	25	5.21%	7	1.46%
Min	5	1.04%	2	0.42%	5	1.04%	15	3.13%	5	1.04%
STD	2.73	0.57%	1.98	0.41%	3.48	0.72%	2.70	0.56%	0.75	0.16%

Max = Maximum, Min = Minimum, Std = Standard Deviation

APPENDIX

SIXTEEN

Indirect Activities

By Day Observed

INDIRECT ACTIVITIES BY DAY OBSERVED

	DAY ONE		DAY TWO		DAY THREE		DAY FOUR		DAY FIVE	
	Intensive Care Area		Intensive Care Area		Intensive Care Area		Intensive Care Area		Special Care Area	
	Time:	0700–1530	Time:	0700–1530	Time:	0700–1530	Time:	0700–1530	Time:	0700–1530
	Minutes =	480	Minutes =	480	Minutes =	480	Minutes =	480	Minutes =	480
	Staff:	C.N.S.	Staff:	C.N.S.	Staff:	C.N.S.	Staff:	RN	Staff:	RN
	No. of Babies	29	No. of Babies	26	No. of Babies	30	No. of Babies	27	No. of Babies	28
	No. of Babies	12	No. of Babies	11	No. of Babies	12	No. of Babies	12	No. of Babies	12
	Time in Minutes	Percent of Total	Time in Minutes	Percent of Total	Time in Minutes	Percent of Total	Time in Minutes	Percent of Total	Time in Minutes	Percent of Total
Oncoming Nursing Round	30	33.71%	30	35.29%	32	35.96%	27	31.40%	29	30.53%
Handover\Reading Notes	5	5.62%	9	10.59%	8	8.99%	8	9.30%	7	7.37%
Checking Environment\Equipment	4	4.49%	4	4.71%	3	3.37%	3	3.49%	5	5.26%
Rounds with Medical Officer	6	6.74%	7	8.24%	6	6.74%	6	6.98%	7	7.37%
Replacing Equipment	3	3.37%	3	3.53%	2	2.25%	3	3.49%	5	5.26%
Discussions with Parents	8	8.99%	19	22.35%	4	4.49%	14	16.28%	12	12.63%
Discussions with Parents	4	4.49%			17	19.10%	5	5.81%	15	15.79%
Discussions with Parents	8	8.99%								
Documentation in Notes	11	12.36%	11	12.94%	10	11.24%	13	15.12%	8	8.42%
Preceptoring	7	7.87%			5	5.62%	5	5.81%	5	5.26%
Outgoing Nursing Round	3	3.37%	2	2.35%	2	2.25%	2	2.33%	2	2.11%
TOTAL	89	100.00%	85	100.00%	89	100.00%	86	100.00%	95	100.00%
TOTAL INDIRECT AS % OF SHIFT		18.54%		17.71%		18.54%		17.92%		19.79%

	DAY SIX		DAY SEVEN		DAY EIGHT		DAY NINE		DAY TEN	
	Special Care Area		Special Care Area		Intensive Care Area		Intensive Care Area		Special Care Area	
	Time:	0700–1530	Time:	0700–1530	Time:	1430–2300	Time:	1430–2300	Time:	1430–2300
	Minutes =	480	Minutes =	480	Minutes =	480	Minutes =	480	Minutes =	480
	Staff:	RN	Staff:	RN	Staff:	RN	Staff:	C.N.S.	Staff:	C.N.S.
	No. of Babies	29	No. of Babies	32	No. of Babies	32	No. of Babies	30	No. of Babies	29
	No. of Babies	12	No. of Babies	13	No. of Babies	13	No. of Babies	12	No. of Babies	12
	Time in Minutes	Percent of Total	Time in Minutes	Percent of Total	Time in Minutes	Percent of Total	Time in Minutes	Percent of Total	Time in Minutes	Percent of Total
Oncoming Nursing Round	30	23.62%	31	27.93%	30	32.61%	35	44.87%	33	34.74%
Handover\Reading Notes	15	11.81%	15	13.51%	5	5.43%	5	6.41%	12	12.63%
Checking Environment\Equipment	6	4.72%	6	5.41%	3	3.26%	2	2.56%	5	5.26%
Rounds with Medical Officer	14	11.02%	10	9.01%	5	5.43%	5	6.41%	10	10.53%
Replacing Equipment	8	6.30%	6	5.41%						
Discussions with Parents	9	7.09%	4	3.60%	20	21.74%	10	12.82%	5	5.26%
Discussions with Parents	9	7.09%	7	6.31%	5	5.43%			5	5.26%
Discussions with Parents	10	7.87%	9	8.11%						
Documentation in Notes	13	10.24%	18	16.22%	12	13.04%	5	6.41%	15	15.79%
Preceptoring	7	5.51%			10	10.87%	13	16.67%	5	5.26%
Outgoing Nursing Round	6	4.72%	5	4.50%	2	2.17%	3	3.85%	5	5.26%
TOTAL	127	100.00%	111	100.00%	92	100.00%	78	100.00%	95	100.00%
TOTAL INDIRECT AS % OF SHIFT		26.46%		23.13%		19.17%		16.25%		19.79%

APPENDIX 16: INDIRECT ACTIVITIES BY DAY OBSERVED

	DAY ELEVEN		DAY TWELVE	
	Intensive Care Area		Special Care Area	
	Time:	2245–0715	Time:	2245–0715
	Minutes =	480	Minutes =	480
	Staff:	C.N.S.	Staff:	RN
	No. of Babies	28	No. of Babies	29
	No. of Babies	12	No. of Babies	12
	Time in Minutes	Percent of Total	Time in Minutes	Percent of Total
Oncoming Nursing Round	31	48.44%	32	48.48%
Handover\Reading Notes	7	10.94%	8	12.12%
Checking Environment\Equipment	2	3.13%	3	4.55%
Rounds with Medical Officer				
Replacing Equipment				
Discussions with Parents	5	7.81%	3	4.55%
Discussions with Parents			3	4.55%
Discussions with Parents			4	6.06%
Documentation in Notes	7	10.94%	8	12.12%
Preceptoring	9	14.06%		
Outgoing Nursing Round	3	4.69%	5	7.58%
TOTAL	**64**	**100.00%**	**66**	**100.00%**
TOTAL INDIRECT AS % OF SHIFT		**13.33%**		**13.75%**

APPENDIX

SEVENTEEN

Expert Nurses' Judgement of Time Taken for Nursing Interventions

APPENDIX 17 – EXPERT NURSE JUDGEMENT OF TIME TAKEN FOR NURSING INTERVENTIONS

Clinical Nurse Specialist	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	N	Mean	Min	Max	Std	Coeff of Var
Admission Level 2	35	30	30	35	30	35	30	30	30	35	35	30	35	30	30	35	16	32.18	30	35	2.48	7.71%
Admission – Level 3	60	55	55	60	55	55	60	55	55	60	60	50	55	60	60	55	16	56.87	50	60	3.00	5.27%
Bath	25	20	20	25	20	25	20	25	25	20	25	20	25	25	25	20	16	22.81	20	25	2.48	10.87%
Sponge Bath	15	15	20	15	15	15	15	20	15	15	15	15	15	20	15	15	16	15.93	15	20	1.95	12.25%
Blood Gas – Arterial	5	7	7	7	7	8	7	7	8	7	7	8	8	7	8	7	16	7.187	5	8	0.73	10.10%
Blood Gas – Peripheral	7	8	7	8	7	7	8	8	8	7	8	7	8	8	8	7	16	7.562	7	8	0.50	6.56%
Blood Glucose Monitoring	4	4	4	5	4	4	4	5	4	4	4	5	4	5	4	4	16	4.25	4	5	0.43	10.19%
Discharge	60	55	55	60	55	55	60	55	55	55	60	55	60	60	60	55	16	57.18	55	60	2.48	4.34%
Extubation	25	20	20	25	20	20	20	25	20	20	20	25	20	20	25	20	16	21.56	20	25	2.32	10.75%
Feeding – bottle	30	25	30	25	30	30	30	30	30	30	30	30	25	30	25	30	16	28.75	25	30	2.17	7.53%
Feeding – Gavage 1/24	8	8	8	9	10	8	9	8	8	9	8	9	8	9	9	8	16	8.5	8	10	0.61	7.20%
Feeding – Gavage 2/24 or 3/24	15	15	15	15	20	15	15	20	15	15	20	20	15	20	15	20	16	16.87	15	20	2.42	14.34%
Fluid LIne Change – Arterial	10	10	10	10	10	12	10	15	10	10	10	12	12	10	12	10	16	10.81	10	15	1.38	12.76%
Fluid Line Change – Central	40	35	35	40	35	40	40	40	45	40	40	35	35	40	45	40	16	39.06	35	45	3.17	8.12%
Fluid Line Change – Venous	20	15	15	15	15	15	20	15	15	15	15	15	15	15	15	15	16	15.62	15	20	1.65	10.58%
Medications– Intravenous Bolus	10	10	10	14	12	13	13	13	14	13	13	14	14	14	13	12	16	12.62	10	14	1.41	11.16%
Medications –Intravenous Infusion	10	10	10	12	10	10	10	12	10	10	10	10	12	10	10	12	16	10.5	10	12	0.87	8.25%
Medications – Oral	3	2	2	3	2	2	3	3	3	3	2	3	3	2	3	3	16	2.625	2	3	0.48	18.44%
General Care – Non Ventilated Infant	12	12	13	14	13	15	14	13	14	15	14	14	15	15	14	14	16	13.81	12	15	0.95	6.88%
General Care – Ventilated Infant	12	15	12	15	15	15	15	15	12	15	15	12	15	15	12	15	16	14.06	12	15	1.39	9.89%
Observations – Non Ventilated Infant	1	1	1	1	2	1	2	1	1	2	2	1	2	2	1	2	16	1.437	1	2	0.50	34.51%
Observations – Ventilated Infant	2	2	3	2	2	2	3	3	3	3	3	2	3	2	3	2	16	2.5	2	3	0.50	20.00%
Parents – Parentcraft	25	20	20	30	25	25	25	25	25	20	25	25	25	25	25	20	16	24.06	20	30	2.63	10.94%
Parents – Assistive Care	10	10	15	10	15	10	10	10	10	10	15	15	10	15	15	10	16	11.87	10	15	2.42	20.38%
Chest Physiotherapy	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	4	16	3.062	3	4	0.24	7.90%
Comfort\Settling – Involved	15	15	15	20	15	20	15	15	20	15	20	15	20	20	20	15	16	17.18	15	20	2.48	14.43%
Comfort\Settling – Simple	5	5	8	8	7	8	8	5	8	5	10	8	8	7	10	8	16	7.375	5	10	1.58	21.37%
E.T.T. Toilet	6	5	5	7	6	6	6	6	6	6	6	5	6	6	6	5	16	5.812	5	7	0.53	9.06%
N.P.T. Toilet	3	3	3	4	3	3	3	4	3	4	4	4	4	3	3	4	16	3.437	3	4	0.50	14.43%
Change Headbox Tubing	8	8	8	8	10	8	10	8	10	8	10	10	8	8	8	10	16	8.75	8	10	0.97	11.07%
Change Ventilator Tubing	10	10	10	10	10	10	10	10	15	10	10	10	10	10	15	10	16	10.62	10	15	1.65	15.56%
Weigh Non Ventilated Infant	7	8	7	10	8	8	8	8	7	8	7	8	8	8	10	7	16	7.937	7	10	0.90	11.33%
Weigh Ventilated Infant	10	10	10	10	10	15	10	10	10	10	10	10	10	10	10	10	16	10.31	10	15	1.21	11.74%

N = Number; Min = Minimum; Max = Maximum; Std = Standard Deviation; Coef of Var = Coefficient of Variation

APPENDIX

EIGHTEEN

Comparison Between Timed Observations and Nurses' Judgement of Time Taken for Nursing Interventions

	EXPERT NURSES ASSESSMENT						OBSERVED RECORDINGS					
	N.	Mean	Max	Min	STD	Coef of Var	N.	Mean	Max	Min	STD	Coef of Var
Observations – Non Ventilated	16	1.44	2	1	0.50	34.51%	16	1.75	2	1	0.43	24.74%
Observations – Ventilated	16	2.50	3	2	0.50	20.00%	16	2.50	3	2	0.50	20.00%
Blood Gas – Arterial	16	7.19	8	5	0.73	10.10%	16	6.94	9	5	1.09	15.68%
Blood Gas – Peripheral	16	7.56	8	7	0.50	6.56%	16	7.25	8	6	0.66	9.12%
Blood Glucose Monitoring	16	4.25	5	4	0.43	10.19%	16	4.00	5	3	0.71	17.68%
Weigh – Non–ventilated	16	7.94	10	7	0.90	11.33%	15	8.13	9	7	0.72	8.83%
Weigh – Ventilated	16	10.31	15	10	1.21	11.74%	15	10.53	11	10	0.50	4.74%
Admission – Level 2	16	32.19	35	30	2.48	7.71%	14	33.93	45	19	8.29	24.44%
Admission – Level 3	16	56.88	60	50	3.00	5.27%	15	53.93	65	32	11.27	20.89%
Feeding – Bottle	16	28.75	30	25	2.17	7.53%	16	27.56	42	12	7.85	28.48%
Feeding – Gavage – Hourly	16	8.50	8	8	0.61	7.20%	16	8.06	10	6	1.60	19.84%
Feeding – Gavage – 2/24 or 3/24	16	16.88	20	15	2.42	14.34%	17	16.00	22	10	3.46	21.65%
Fluid Line Change – Arterial	16	10.81	15	10	1.38	12.76%	15	11.80	17	7	3.08	26.11%
Fluid Line Change – Central	16	39.06	45	35	3.17	8.12%	16	39.19	50	25	8.13	20.76%
Fluid Line Change – Venous	16	15.63	20	15	1.65	10.58%	14	16.43	18	15	1.12	6.79%
Bath – Immersion	16	22.81	25	20	2.48	10.87%	16	21.44	24	19	1.37	6.38%
Bath – Sponge	16	15.94	20	15	1.95	12.25%	16	15.25	17	11	1.25	8.20%
Suction – ETT	16	5.81	7	5	0.53	9.06%	16	6.06	8	5	0.56	9.16%
Suction – NPT	16	3.44	4	3	0.50	14.43%	15	3.53	4	3	0.50	14.12%
Tubing Change – Headbox	16	8.75	10	8	0.97	11.07%	15	10.07	11	8	0.77	7.67%
Tubing Change – Ventilator	16	10.63	15	10	1.65	15.56%	16	10.44	11	8	1.00	9.56%
Physiotherapy – Chest	16	3.06	4	3	0.24	7.90%	15	3.00	4	2	0.37	12.17%
General Care Cluster – Non Ventilated	16	13.81	15	12	0.95	6.88%	18	13.06	14	11	0.85	6.50%
General Care Cluster – Ventilated	16	14.06	15	12	1.39	9.89%	18	13.94	15	13	0.62	4.45%
Cmfort\Settling – Involved	16	17.19	20	15	2.48	14.43%	16	19.63	40	8	10.25	52.21%
Comfort\Settling – Simple	16	7.38	10	5	1.58	21.37%	17	7.76	9	6	0.88	11.29%
Medications – Intravenous Bolus	16	12.63	14	10	1.41	11.16%	16	13.38	17	11	1.41	10.53%
Medications – Intravenous Infusion	16	10.50	12	10	0.87	8.25%	17	11.35	13	10	0.90	7.96%
Medications – Oral	16	2.63	3	2	0.48	18.44%	16	2.44	3	2	0.50	20.35%
Extubation	16	21.56	25	20	2.32	10.75%	14	20.50	22	18	1.18	5.76%
Parental Education – Parentcraft	16	24.06	30	20	2.63	10.94%	17	22.94	32	10	6.35	27.67%
Parental Education – Assistive	16	11.88	15	10	2.42	20.38%	16	10.31	17	7	2.64	25.59%
Discharge	16	57.19	60	55	2.48	4.34%	17	57.00	70	40	8.15	14.30%
TOTAL	528					TOTAL	524					

N = Number, Min = Minimum Max = Maximum Coef of Var = Coefficient of Variation

APPENDIX

NINETEEN

Comparison Between Timed Observations and Nurses' Judgement of Time Taken for Nursing Interventions

Kendall Coefficient of Concordance

Clinical Nurse Specialist	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Rank Sum
Admission Level 2	30	30	29.5	30	29.5	30	29.5	29.5	29.5	30	30	29.5	30.5	29.5	30	30	477.000
Admission – Level 3	32.5	32.5	32.5	32.5	32.5	32.5	32.5	32.5	32.5	33	32.5	32	32	32.5	32.5	32.5	519.500
Bath	27	27	26.5	27	26	27.5	26	27	27.5	27	27.5	25.5	28	27.5	27.5	26.5	431.000
Sponge Bath	23	23	26.5	22.5	22	21.5	22.5	24.5	22.5	22.5	21.5	22.5	22	24.5	22	22.5	365.500
Blood Gas – Arterial	7.5	9	9	7.5	9	11	8	9	10.5	9.5	8.5	10	10.5	8.5	9	9	145.500
Blood Gas – Peripheral	10.5	11.5	9	10	9	8	10	11.5	10.5	9.5	10.5	8	10.5	11	9	9	157.500
Blood Glucose Monitoring	6	6	6	6	6	6	6	6.5	6	5.5	5.5	6.5	5.5	6	6	5	94.500
Discharge	32.5	32.5	32.5	32.5	32.5	32.5	32.5	32.5	32.5	32	32.5	33	33	32.5	32.5	32.5	520.500
Extubation	27	27	26.5	27	26	25.5	26	27	25.5	27	25	27.5	25.5	24.5	27.5	26.5	421.000
Feeding – bottle	29	29	29.5	27	29.5	29	29.5	29.5	29.5	29	29	29.5	28	29.5	27.5	29	463.000
Feeding – Gavage 1/24	12.5	11.5	12	12	14.5	11	12	11.5	10.5	13	10.5	12	10.5	13	11	11.5	189.000
Feeding – Gavage 2/24 or 3/24	23	23	22.5	22.5	26	21.5	22.5	24.5	22.5	22.5	25	25.5	22	24.5	22	26.5	376.000
Fluid LIne Change – Arterial	16.5	16.5	16	15	14.5	17	15.5	21.5	15	16	14.5	17.5	17.5	15.5	16.5	15	260.000
Fluid Line Change – Central	31	31	31	31	31	31	31	31	31	31	31	31	30.5	31	31	31	495.500
Fluid Line Change – Venous	25	23	22.5	22.5	22	21.5	26	21.5	22.5	22.5	21.5	22.5	22	20.5	22	22.5	360.000
Medications– Intravenous Bolus	16.5	16.5	16	19.5	18	18	19	18.5	19.5	19	18	19.5	19	18	18	18.5	291.500
Medications –Intravenous Infusion	16.5	16.5	16	18	14.5	15	15.5	17	15	16	14.5	14.5	17.5	15.5	13.5	18.5	254.000
Medications – Oral	4	2.5	2	3.5	2	2.5	3.5	3	3.5	3	1.5	3.5	3	2	3.5	3	46.000
General Care – Non Ventilated Infant	20.5	20	20	19.5	19	21.5	20	18.5	19.5	22.5	19	19.5	22	20.5	19	20	321.000
General Care – Ventilated Infant	20.5	23	19	22.5	22	21.5	22.5	21.5	18	22.5	21.5	17.5	22	20.5	16.5	22.5	333.500
Observations – Non Ventilated Infant	1	1	1	1	2	1	1	1	1	1	1.5	1	1	2	1	1.5	19.000
Observations – Ventilated Infant	2	2.5	4	2	2	2.5	3.5	3	3.5	3	3.5	2	3	2	3.5	1.5	43.500
Parents – Parentcraft	27	27	26.5	29	28	27.5	28	27	27.5	27	27.5	27.5	28	27.5	27.5	26.5	439.000
Parents – Assistive Care	16.5	16.5	22.5	15	22	15	15.5	15	15	16	21.5	22.5	15	20.5	22	15	285.500
Chest Physiotherapy	4	4.5	4	3.5	4.5	4.5	3.5	3	3.5	3	3.5	3.5	3	4.5	3.5	5	61.000
Comfort\Settling – Involved	23	23	22.5	25	22	25.5	22.5	21.5	25.5	22.5	25	22.5	25.5	24.5	25	22.5	378.000
Comfort\Settling – Simple	7.5	7.5	12	10	9	11	10	6.5	10.5	7	14.5	10	10.5	8.5	13.5	11.5	159.500
E.T.T. Toilet	9	7.5	7	7.5	7	7	7	8	7	8	7	6.5	7	7	7	7	116.500
N.P.T. Toilet	4	4.5	4	5	4.5	4.5	3.5	5	3.5	5.5	5.5	5	5.5	4.5	3.5	5	73.000
Change Headbox Tubing	12.5	11.5	12	10	14.5	11	15.5	11.5	15	11.5	14.5	14.5	10.5	11	9	15	199.500
Change Ventilator Tubing	16.5	16.5	16	15	14.5	15	15.5	15	22.5	16	14.5	14.5	15	15.5	22	15	259.000
Weigh Non Ventilated Infant	10.5	11.5	9	15	11	11	10	11.5	8	11.5	8.5	10	10.5	11	13.5	9	171.500
Weigh Ventilated Infant	16.5	16.5	16	15	14.5	21.5	15.5	15	15	16	14.5	14.5	15	15.5	13.5	15	249.500

Friedman test statistic = 497.584
Kendall coefficient of concordance = 0.972
Probability is under 0.001 assuming chi–square distribution with 32 degrees of freedom

APPENDIX 20

RESOURCE PACKAGE FOR CLINICAL NURSES

NEONATAL NURSING INTENSITY TOOL (N.N.I.T.)

RESOURCE PACKAGE FOR

CLINICAL NURSES

THE NEONATAL NURSING

INTENSITY TOOL

(N.N.I.T.)

Developed: *August, 1993*

Revised:

The Neonatal Nursing Intensity System is a patient classification system which is designed to provide information about the number of nurses who are needed to provide care to the neonates in the unit.

The Neonatal Nursing Intensity Tool is the area where the clinical nurses document the care they attend, and the Neonatal Nursing Intensity Compilation Sheet is the document the Nursing Unit Manager uses to convert this information and calculate the number of nurses required per shift and per day.

Assessment of the patient and accurate documentation of the interventions you attend is critical for the calculation of accurate staffing figures. Education sessions have been attended on the use of the N.N.I.T., if you were unable to attend this or have any questions, please see either the Nursing Unit Manager or the educator.

Enclosed in this resource package are blank N.N.I.T. forms, and completed examples for you to look at.

If you have any comments about the N.N.I.T., please discuss this with the Nursing Unit Manager.

NEONATAL NURSING INTENSITY TOOL

Patient Identification	Date: _____

Interventions	Code:								A.M.	P.M.	N.D.
Observations: Attend per Shift											
Observations: Ventilated Neonate	1/24	20	2/24	10							
Observations: NonVentilated Neonate	1/24	14	2/24	7	3/24	5	4/24	4			
Blood Gas Analysis	1	7	2	14	3	21	4	28			
Heel Prick Blood Glucose	1	4	2	8	3	12	4	16			
Parenteral Fluids: Change per Shift											
Intravenous\Umbilical	1	16	2	33	3	49	4	66			
Arterial	1	12	2	24	3	35	4	47			
C.V.L.	1	39	2	78	3	118	4	157			
Enteral Fluids: Offer per Shift											
Bottle	1	28	2	55	3	83	4	110			
Gavage	1/24	64	2/24	64	3/24	43	4/24	32			
Medications: Attend per Shift											
I.V. Bolus	1	7	2	13	3	20	4	27			
I.V. Infusion	1	11	2	23	3	34	4	45			
Oral	1	2	2	5	3	7	4	10			
Respiratory Care: Attend per Shift											
E.T.T. Toilet	1/24	48	2/24	24	3/24	16	4/24	12			
N.P.T. Toilet	1/24	28	2/24	14	3/24	9	4/24	7			
Chest Physio	1/24	24	2/24	12	3/24	8	4/24	6			
Hygiene\General Care: Attend per Shift											
General Care					3/24	36	4/24	27			
Comfort\Settling – Simple	1	8	2	16	3	23	4	31			
Comfort\Settling – Involved	1	20	2	39	3	59	4	79			
Bath	1	21	2	43							
Sponge	1	15	2	31							
Dressings	1	14	2	28							
Ventilator\Headbox Tubing Change	1	10	2	20							
Others: Attend per Shift											
Venous Cannulation	1	13	2	26							
Arterial Cannulation	1	17	2	34							
Catheterisation (UA,UV,CVL)	1	30	2	60							
X–Ray	1	8	2	16							
Ultrasound	1	10	2	20							
Intubation	1	26	2	52							
Extubation	1	21	2	41							
Weigh	1	10	2	19							
Parent Education: Attend per Shift											
Assist with Care	1	10	2	21							
Parentcraft	1	23	2	46							
Admission\Discharge											
Admission Ventilated	1	54									
Admission Non Ventilated	1	34									
Discharge	1	57									
	Weighted Factor (Add)								39	37	27
	TOTAL PER SHIFT										
	TOTAL PER DAY										

The Neonatal Nursing Intensity Tool - Reverse Side - Instructions for Use

The Neonatal Nursing Intensity Tool (N.N.I.T.) may be completed throughout the shift and must be completed close to the end of the shift.

Select the interventions, and the frequency with which you have attended these interventions, during your shift. Choose the coded figure (in the shaded section immediately to the right of the chosen frequency) and document this figure in the space allocated for your shift. At the end of your shift, add the figures in the column, include the weighted figure and document this total in the space provided at the bottom of the N.N.I.T.

If you find you attend any intervention in the "others", "parent education" or "hygiene" category more times than provided for (eg, dressings, X-Ray or parent education three times in your shift) select the code for one attendance and multiply that by the number of times you attended this and then document this figure in the appropriate spot. (For example: X-Ray attended three times - select code 8, multiply this by three to give 24. Document the figure 24 in the appropriate area and note on the N.N.I.T. that this has occurred by marking X3 next to X-Ray).

Note: **Parentcraft education** includes teaching bathing, feeding, oxygen management or wound dressings (e.g. colostomy).
Assisting with care education include teaching the parents to attend eye, oral and umbilical care, and nappy changing.

Simple comfort\settling activities include stroking and gentle speech.
Involved comfort\settling activities include cuddling, relaxation bathing or relaxation massage.

There are examples of completed N.N.I.T. forms in the Neonatal Nursing Intensity System Resource Package in the ward.

NEONATAL NURSING INTENSITY TOOL

Patient Identification	Date:

Interventions	Code:								A.M.	P.M.	N.D.
Observations: Attend per Shift											
Observations: Ventilated Neonate	1/24	20	2/24	10					20	20	20
Observations: NonVentilated Neonate	1/24	14	2/24	7	3/24	5	4/24	4			
Blood Gas Analysis	1	7	2	14	3	21	4	28	14	7	7
Heel Prick Blood Glucose	1	4	2	8	3	12	4	16			
Parenteral Fluids: Change per Shift											
Intravenous\Umbilical	1	16	2	33	3	49	4	66	16		
Arterial	1	12	2	24	3	35	4	47	12		
C.V.L.	1	39	2	78	3	118	4	157		39	
Enteral Fluids: Offer per Shift											
Bottle	1	28	2	55	3	83	4	110			
Gavage	1/24	64	2/24	64	3/24	43	4/24	32			
Medications: Attend per Shift											
I.V. Bolus	1	7	2	13	3	20	4	27	13	13	13
I.V. Infusion	1	11	2	23	3	34	4	45	11		11
Oral	1	2	2	5	3	7	4	10			
Respiratory Care: Attend per Shift											
E.T.T. Toilet	1/24	48	2/24	24	3/24	16	4/24	12	48	48	48
N.P.T. Toilet	1/24	28	2/24	14	3/24	9	4/24	7			
Chest Physio	1/24	24	2/24	12	3/24	8	4/24	6	12	12	12
Hygiene\General Care: Attend per Shift											
General Care					3/24	36	4/24	27	27	27	27
Comfort\Settling – Simple	1	8	2	16	3	23	4	31	8	8	
Comfort\Settling – Involved	1	20	2	39	3	59	4	79			
Bath	1	21	2	43							
Sponge	1	15	2	31						15	
Dressings	1	14	2	28							
Ventilator\Headbox Tubing Change	1	10	2	20							
Others: Attend per Shift											
Venous Cannulation	1	13	2	26							
Arterial Cannulation	1	17	2	34							
Catheterisation (UA,UV,CVL)	1	30	2	60							
X–Ray	1	8	2	16					8		
Ultrasound	1	10	2	20						10	
Intubation	1	26	2	52							
Extubation	1	21	2	41							
Weigh	1	10	2	19						10	
Parent Education: Attend per Shift											
Assist with Care	1	10	2	21						10	
Parentcraft	1	23	2	46							
Admission\Discharge											
Admission Ventilated	1	54									
Admission Non Ventilated	1	34									
Discharge	1	57									
									39	37	27
									228	256	165
											649

Weighted Factor (Add)

TOTAL PER SHIFT

TOTAL PER DAY

NEONATAL NURSING INTENSITY TOOL

Patient Identification	Date: _____

Interventions	Code:								A.M.	P.M.	N.D.
Observations: Attend per Shift											
Observations: Ventilated Neonate	1/24	20	2/24	10							
Observations: NonVentilated Neonate	1/24	14	2/24	7	3/24	5	4/24	4	7	7	7
Blood Gas Analysis	1	7	2	14	3	21	4	28			
Heel Prick Blood Glucose	1	4	2	8	3	12	4	16	8	8	8
Parenteral Fluids: Change per Shift											
Intravenous\Umbilical	1	16	2	33	3	49	4	66			
Arterial	1	12	2	24	3	35	4	47			
C.V.L.	1	39	2	78	3	118	4	157			
Enteral Fluids: Offer per Shift											
Bottle	1	28	2	55	3	83	4	110			
Gavage	1/24	64	2/24	64	3/24	43	4/24	32	64	64	64
Medications: Attend per Shift											
I.V. Bolus	1	7	2	13	3	20	4	27			
I.V. Infusion	1	11	2	23	3	34	4	45			
Oral	1	2	2	5	3	7	4	10	2		2
Respiratory Care: Attend per Shift											
E.T.T. Toilet	1/24	48	2/24	24	3/24	16	4/24	12			
N.P.T. Toilet	1/24	28	2/24	14	3/24	9	4/24	7			
Chest Physio	1/24	24	2/24	12	3/24	8	4/24	6			
Hygiene\General Care: Attend per Shift											
General Care					3/24	36	4/24	27	27	27	27
Comfort\Settling – Simple	1	8	2	16	3	23	4	31	8		8
Comfort\Settling – Involved	1	20	2	39	3	59	4	79		20	
Bath	1	21	2	43					21		
Sponge	1	15	2	31							
Dressings	1	14	2	28							
Ventilator\Headbox Tubing Change	1	10	2	20							
Others: Attend per Shift											
Venous Cannulation	1	13	2	26							
Arterial Cannulation	1	17	2	34							
Catheterisation (UA,UV,CVL)	1	30	2	60							
X–Ray	1	8	2	16							
Ultrasound	1	10	2	20							
Intubation	1	26	2	52							
Extubation	1	21	2	41							
Weigh	1	10	2	19					10		
Parent Education: Attend per Shift											
Assist with Care	1	10	2	21							
Parentcraft	1	23	2	46						23	
Admission\Discharge											
Admission Ventilated	1	54									
Admission Non Ventilated	1	34									
Discharge	1	57									
								Weighted Factor (Add)	39	37	27
								TOTAL PER SHIFT	186	186	143
								TOTAL PER DAY			515

APPENDIX 21

RESOURCE PACKAGE FOR NURSE ADMINISTRATOR

NEONATAL NURSING INTENSITY COMPILATION SHEET (N.N.I.C.S.)

RESOURCE PACKAGE FOR

NURSE ADMINISTRATOR

THE NEONATAL NURSING

INTENSITY COMPILATION

SHEET

(N.N.I.C.S.)

Developed: *August, 1993*

Revised:

The Neonatal Nursing Intensity System is a patient classification system which is designed to provide information about the number of nurses who are needed to provide care to the neonates in the unit.

The Neonatal Nursing Intensity Tool is the area where the clinical nurses document the care they attend, and the Neonatal Nursing Intensity Compilation Sheet (N.N.I.C.S.) is the document the Nursing Unit Manager uses to convert this information and calculate the number of nurses required per shift and per day.

The (N.N.I.C.S.) is the administrative summary designed to record data for all staffing needs per patient per day. Areas are available for nursing hours per patient day (N.H.P.P.D.) to be calculated, for the required nursing numbers to be calculated and the available nursing numbers documented. Any variance can then be shown.

Enclosed in this resource package are blank N.N.I.C.S. forms, and completed examples for you to look at.

If you have any comments about the N.N.I.C.S., please discuss this with the implementation coordinator.

NEONATAL NURSING INTENSITY SYSTEM COMPILATION SHEET

Date: ____________________________

Name	Morning	Afternoon	Night	Total

Totals:	Morning	Evening	Night	Total
TOTAL CODES				
NHPPD				
RN Required				
RN Available				
Variance				

Figure 6: The Neonatal Nursing Intensity Compilation Sheet - Reverse Side - Instructions for Use

1 To calculate the nursing hours per patient day (N.H.P.P.D). required, divide the calculated code by 60 (minutes per hour).

example: code for 24 hours = 692 = 11.5 N.H.P.P.D.
minutes per hour 60

2 To calculate nursing staff required per day, divide the N.H.P.P.D. by 8 (an eight hour shift).

example: N.N.P.P.D required = 11.5 = 1.43 R.N.
R.N. hours available 8

3 To calculate nursing hours available, multiply the number of registered nurses rostered by 8 (hours per nurse).

example: 12 (R.N.) X 8 (hours) = 96 nursing hours available.

4 To calculate the variance, deduct the number of nurses available from the number of nurses required.

example: R.N. required = 16.4 = 1.04 R.N. deficit
R.N. available = 15.0

NEONATAL NURSING INTENSITY SYSTEM COMPILATION SHEET

Date: _____

Name	Morning	Afternoon	Night	Total
	188	186	144	518
	230	256	166	652
	186	188	150	524
	256	230	186	672
	230	256	166	652
	220	224	210	654
	228	210	206	644
	230	238	166	634

Totals:	Morning	Evening	Night	Total
TOTAL CODES	1768	1788	1394	4950
NHPPD	29.47	29.80	23.23	82.50
RN Required	3.68	3.73	2.90	10.31
RN Available	4	5	3	12
Variance	0.32	1.28	0.10	1.69

NEONATAL NURSING INTENSITY SYSTEM COMPILATION SHEET

Date: _____

Name	Morning	Afternoon	Night	Total
	170	168	130	468
	200	240	126	566
	170	168	140	478
	230	190	166	586
	210	230	160	600
	199	198	200	597
	216	198	187	601
	240	208	150	598

Totals:	Morning	Evening	Night	Total
TOTAL CODES	1635	1600	1259	4494
NHPPD	27.25	26.67	20.98	74.90
RN Required	3.41	3.33	2.62	9.36
RN Available	3	3	3	9
Variance	−0.41	−0.33	0.38	−0.36